Regional Transit Project

King County • Pierce County • Snohomish County

Final Environmental Impact Statement Regional Transit System Plan

March 1993

Metro

Pierce Transit

Community Transit

Everett Transit

SNO-TRAN

Washington State Department of Transportation

Volume 1

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Regional Transit System Plan

Final Environmental Impact Statement

Volume 1

FEIS Text

March 1993

<u>Issuing Agencies</u>

Community Transit

Everett Transit

Metro (SEPA Lead Agency)

Pierce Transit

SNO-TRAN

Washington State Department of Transportation

Prepared in compliance with the State Environmental Policy Act (RCW 43.21C) and Metro Resolutions 4480 and 4925 implementing SEPA in Metro procedures.

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COVER MEMO

The modern era of rapid transit planning began in Seattle in the mid-1960s. Proposals for a rail transit system were not approved by the voters in 1968 and again in 1970. Rapid transit planning was revived by the Puget Sound Council of Governments (PSCOG) in 1981. In 1986, the Municipality of Metropolitan Seattle (Metro) and PSCOG completed the Multi-Corridor project, which recommended that a passenger rail system be in operation by 2020. In 1988, the PSCOG Assembly adopted a policy advancing the planning schedule for rail to begin operating by the year 2000. In 1990, the Washington State Legislature established the State High-Capacity Transportation (HCT) program, which provided a mechanism and funding for preparation and adoption of a regional HCT plan in the central Puget Sound region. In response, Metro began preparing detailed alternatives analysis. By the spring of 1991, however, it became evident that rapid transit planning had to proceed within the context of an overall regional transit plan. Metro, Pierce Transit, and the Snohomish County Transportation Authority (SNO-TRAN) then began preparing a comprehensive plan for regional transit in the year 2020, when the initial network of rapid transit lines could be completed. The Regional Transit System Plan is the result of that effort.

Metro is issuing this final environmental impact statement (FEIS) with Community Transit, Everett Transit, Pierce Transit, SNO-TRAN, and WSDOT under the guidance of the Joint Regional Policy Committee (JRPC). The FEIS examines alternatives to and the environmental impacts of the Regional Transit System Plan, which includes proposals for significant transit capital and service improvements in King, Pierce, and Snohomish counties, including building a regional rapid-transit system. The proposed capital and service improvements are needed to increase the speed and efficiency of public transit, provide a more attractive alternative to using single-occupant motor vehicles, improve regional mobility, and support regional growth management and air quality programs.

The System Plan FEIS is intended to provide a broad overview of rapid transit improvements. It is considered to be a "programmatic" FEIS under the State Environmental Policy Act (SEPA). Project-specific environmental review will be carried out for each transit corridor after adoption of a preferred alternative by the JRPC. The project-specific review will meet both the State and National Environmental Policy Act requirements. In addition, related Transportation Systems Management (TSM) improvements will also be addressed in subsequent environmental review. SEPA encourages agencies to review general programs in broader environmental documents, with subsequent documents concentrating solely on project-specific issues. The analysis in this programmatic FEIS will be used to narrow the range of alternatives to be considered in subsequent environmental review.

The System Plan FEIS identifies and compares the environmental impacts associated with three alternatives for expanding transit facilities and service, as well as a No-Build Alternative to serve as an environmental baseline. While all three build alternatives represent similar bus service increases, they represent different philosophies and cost levels for improving regional transit. The lowest-cost alternative - the TSM Alternative - represents the improved transit efficiency that can be achieved by completing the regional high-occupancy-vehicle (HOV) system, adding significant HOV improvements to regional arterials, and greatly expanding park-and-ride lot capacity. The intermediate-cost alternative - the Transitway/TSM Alternative - adds exclusive transitways in the core of the region

to the improvements planned under the TSM Alternative. The higher cost Rail/TSM Alternative provides an extensive regional rail system with most of the service and capital improvements proposed for the TSM Alternative.

Major issues addressed in the System Plan FEIS include the effect of each of the alternatives on regional transportation, including transit service and traffic; the degree to which each alternative supports PSCOG's Vision 2020 land-use plan and the goals of the Growth Management Act; consistency with land-use patterns and growth management planning; the potential construction impacts of each alternative; potential impacts on the natural environment; potential impacts on the built environment; and potential impacts on people in the region, including noise, air quality, and visual impacts.

Chapter 1 in this FEIS provides an introduction to the system plan, its purpose and the needs it is serving, the scope of the FEIS, the history of corridor and alignment screening, and the public involvement and decision making processes for the project. Chapter 2 describes the System Plan alternatives, including variations and supplements, and explains why other alternatives are not considered in detail in the FEIS. Chapter 3 describes the results of the evaluation of impacts and potential mitigation measures for each of the alternatives. Chapter 4 describes the consistency of the alternatives with Vision 2020 and countywide growth management planning. Chapter 5 summarizes the comments received on the draft Environmental Impact Statement.

FACT SHEET

Nature and Location of Proposal

The Regional Transit System Plan study area is the urbanized part of King, Pierce, and Snohomish Counties, extending roughly from Marysville in the north to Lakewood south of Tacoma, bounded by Puget Sound on the west and the Cascade foothills on the east. The alternatives discussed in this programmatic Final Environmental Impact Statement (FEIS) encompass a range of major capital improvements to the region's transit and high-occupancy-vehicle infrastructure, as well as significant transit service expansion in the region. A No-Build Alternative and three action alternatives are examined: Transportation Systems Management (TSM); Transitway/TSM; and Rail/TSM.

The TSM Alternative includes:

- completing the regional high-occupancy vehicle (HOV) lane system
- adding HOV lanes and other improvements on many of the region's arterials and highways
- converting the I-90 center roadway to a 2-way busway
- expanding park-and-ride capacity
- investment in pedestrian, bicycle, and transit-friendly facilities along major transit corridors
- a substantial increase in transit funding, with most of the increase used to expand service in suburban areas. The increase would be distributed proportionately by population.

The Transitway/TSM Alternative includes:

- the service and most of the capital improvements proposed under the TSM Alternative
- an exclusive transitway from downtown Seattle to Northgate along the Interstate 5 express lanes
- an exclusive busway from downtown Seattle to Tukwila along existing railroad right-of-way
- an exclusive busway from downtown Seattle through Bellevue along segments of Interstate 90, Interstate 405, 114th SE, and existing railroad right-of-way.

The Rail/TSM Alternative includes:

- the service and many of the capital improvements proposed under the TSM Alternative
- rapid rail from Seattle to Everett by way of Capitol Hill (JRPC recommended alignment) or I-5 through the University District. A branch line or through routing would also serve Paine Field.
- rapid rail from Seattle to Tacoma by way of Rainier Valley (JRPC recommended alignment) or Boeing Field
- rapid rail from Seattle to Bellevue, with spurs extending to Issaquah, Redmond, and Lynnwood
- rapid rail in the I-405/State Route 518 corridor from Bellevue to Burien
- commuter rail through the Puyallup and Green River valleys from Tacoma to Seattle.

Proponents:

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1133 164th Street Southwest
Suite 200
Lynnwood, WA 98037
(206) 348-7190

Everett Transit
3200 Cedar Street
Everett, WA 98201
(206) 259-8908

Municipality of Metropolitan Seattle (Metro)
Regional Transit Project
821 2nd Avenue
M.S. 151
Seattle, WA 98104-1598
(206) 684-1999 or (800) 894-1548

Pierce Transit
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Tacoma, WA 98499-0070
(206) 581-8000

Snohomish County Transportation Authority (SNO-TRAN)
1133 164th Street Southwest
Suite 102
Lynnwood, WA 98037
(206) 787-1901

Washington State Department of Transportation (WSDOT)

401 2nd Avenue South	or	Transportation Building
Seattle, WA 98104		Olympia, WA 98504
(206) 464-5878		(206) 753-2931

Proposed Implementation Date:

Regardless of the alternative selected, work on project-level EISs and preliminary engineering and design could begin in 1993 and, assuming the voters approve funding, service expansion could begin in 1994.

If the Transitway/TSM Alternative is chosen, construction would be complete and full operation would begin in 1999. If the Rail/TSM Alternative is selected, the south corridor commuter rail service could begin in 1996. Operation of initial rapid rail segments could begin four years later, in 2000. Final construction would end between 2000 and 2020.

Lead Agency:

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Regional Transit Project
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M.S. 151
Seattle, WA 98104-1598
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Licenses Required:

No licenses are required before the Joint Regional Policy Committee (JRPC), made up of representatives of the proponent agencies, adopts a Regional Transit System Plan. Licenses required to implement specific components recommended in the System Plan will be identified in subsequent environmental review. Upon adoption, the JRPC will transmit the System Plan to the King, Pierce, and Snohomish County councils for their approval, which will set in motion the formation of a Regional Transit Authority (RTA) covering portions of the three counties. The RTA in turn will present the System Plan to the voters for approval. The System Plan also must be approved by the Federal Transit Administration (FTA) before the RTA proceeds with the next step in the planning process.

Authors and Principal Contributors:

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Ecosystems	BRW/Don Shimono Associates

Draft EIS Issue Date:

October 12, 1992

Final EIS Issue Date:

March 3, 1993

Nature and Date of Final Action:

Adoption of a System Plan by the Joint Regional Policy Committee in Spring 1993.

Type and Timing of Subsequent Environmental Review:

This programmatic FEIS is part of a "phased" environmental review process. If a rapid transit alternative is chosen, one or more project-level Draft Environmental Impact Statement(s) would be completed by early 1994. Preliminary design and the Final Environmental Impact Statement(s) would be completed by early 1995. Commuter rail and Transportation Systems Management capital projects would receive more environmental review on a project-by-project basis from 1993 to 2020, as appropriate.

Previous Environmental Review:

The following studies provide the background for the current planning effort and are incorporated by reference into this EIS:

> Snohomish County Transportation Authority. *Public Transportation Plan for Snohomish County, Washington. Final Environmental Impact Statement.* (1989).
>
> Pierce County. *Pierce County Transportation Plan Policy Document. Final Environmental Impact Statement.* (1989).
>
> Puget Sound Council of Governments. *Vision 2020; Growth Strategy and Transportation Plan for the Central Puget Sound Region; Final Environmental Impact Statement.* (1990).

The documents mentioned here, as well as technical reports, background data, and supporting information, may be viewed at the Metro Library, Ninth Floor, Exchange Building, 821 Second Avenue, Seattle, Washington.

Location of EIS Background Data:

Metro Library
Municipality of Metropolitan Seattle
821 2nd Avenue
9th Floor
Seattle, Washington

Cost of a Copy of the Final EIS:

The *Regional Transit System Plan Final EIS* is available at no cost to interested citizens and groups. Copies may be obtained from Metro's Environmental Compliance Division, 821 Second Avenue, M.S. 120 (12th floor), Seattle, WA 98104-1598 or by phoning (206) 684-1165 or (206) 684-1682 (TTY). One copy will be provided to each individual.

Appeals:

Appeals of SEPA procedural determinations, including challenges to the FEIS, are governed by Metro Resolution Nos. 4480 and 4925. Copies of these resolutions are available from Metro by calling the contact person listed above.

To be timely, a letter of appeal must be delivered or mailed to Metro's Executive Director (Municipality of Metropolitan Seattle, 9th floor, Exchange Building, 821 Second Avenue, Seattle, WA 98104) within fifteen (15) days of the date the challenged environmental document is issued. The required form and content of a letter of appeal are set forth in the resolutions cited above. If a hearing is requested in any proper letter of appeal, that hearing will begin on Wednesday, March 31, 1993.

Copies of the administrative record and related documents are available for review at the Metro Library, Municipality of Metropolitan Seattle, 821 Second Avenue, 9th floor, Seattle, WA 98104.

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Executive Summary

The Regional Transit Project (RTP) is a cooperative project among the Municipality of Metropolitan Seattle (Metro), Pierce Transit, and Snohomish County transit planning and operating agencies, including Snohomish County Transportation Authority (SNO-TRAN), Community Transit, and Everett Transit. Elected officials from the governing boards of these transit agencies and the secretary of the State Department of Transportation (WSDOT) form a Joint Regional Policy Committee (JRPC) to guide the project. The JRPC is proposing a System Plan for joint public transit development in the three-county region made up of parts of King, Pierce, and Snohomish counties. The Final Environmental Impact Statement provides a programmatic analysis for the year 2020 of the alternatives developed to respond to the transit needs and serves as input, along with other evaluation criteria, to decisions on the System Plan by the JRPC.

The System Plan is designed to implement the public transportation objectives adopted by the Puget Sound Council of Governments (PSCOG), now the Puget Sound Regional Council (PSRC) in 1990. The System Plan also responds to initiatives from the Washington State Legislature for growth management, high-capacity transit planning, limiting single-occupant vehicle (SOV) trips to major employment sites, and addressing the air quality nonattainment status of large portions of King, Pierce, and Snohomish counties under federal law. The System Plan proposes a major public transit investment to help meet the region's transportation needs.

Vision 2020's transportation goals are integral to the region's land-use vision, which includes limiting growth on the urban fringe and concentrating new development in already developed and developing centers. The Vision 2020 plan aims to contain urban residential growth and concentrate new employment growth in 12 to 17 urban centers that could be efficiently served by regional rapid transit. Access to jobs by transit as an alternative to the single-occupant vehicle (SOV) is emphasized. The vision allocates a large share of transportation investment to rapid transit, buses, and high-occupancy-vehicle facilities. It also includes a major shift in local bus service to provide service to each center from surrounding areas. The vision supports major transportation demand management programs that encourage people to use transit, carpool, or nonmotorized modes. These strategies include extensive ridesharing programs, parking charges for SOVs, preferential parking for HOVs, and transit pass fare subsidies.

The Vision 2020 goals focus on managing regional growth and preventing further deterioration of the quality of life due to urban sprawl, traffic congestion, pollution, and environmental degradation. By laying out a plan for managing regional growth, Vision 2020 is a basis for responding to the mandate of Washington State's Growth Management Act. Recently enacted growth management, transportation management, and air quality management laws (Chapter 36.70A RCW, Chapter 81.104 RCW, and the federal Clean Air Act Amendments) all mandate creating attractive alternatives to automobile use in general, and to single-occupant vehicle use in particular. The System Plan responds to these mandates.

Proposal And Objectives

The Regional Transit Project (RTP) has four main goals. The first goal is to **ensure the ability to move around the region** by providing reliable, convenient, and safe public transportation services throughout the region. Strategies to reach this objective include:

- o operate a public transit system that is reliable, affordable, accessible, safe, and attractive
- o take steps to create competitive advantages for transit by removing it from mixed traffic or giving it priority.

The second goal is to **preserve communities and open space** by supporting communities' ability to develop in ways that preserve and enhance their livability and limit intrusion into rural areas. Strategies to reach this objective include:

- o reinforce desirable community characteristics
- o stimulate the development of desirable characteristics.

The third goal is to **improve the region's economic vitality** by increasing access to jobs, education, and other community resources. Strategies to achieve this objective include:

- o improve transit access to jobs and other activities
- o provide services and facilities that benefit all socioeconomic groups.

The fourth goal is to **preserve environmental quality** by conserving land and energy resources and containing growth in air pollution. Strategies to achieve this objective include:

- o reduce single-occupancy vehicle use
- o support Vision 2020 centers-oriented land use.

To reach these goals, the RTP is committed to working with community, environmental, and business groups to develop a comprehensive public transportation plan to present to the voters. The plan will increase transit's market share, help reduce single-occupant vehicle use, and provide an early return on the transit investment by immediately expanding transit service. When combined with growth management strategies and an aggressive regional transportation demand management (TDM) program, the plan will provide necessary transportation capacity to serve as an increasingly important alternative to the SOV.

The Regional Transit System Plan proposes capital improvements and service expansion that will increase transit speeds and reliability, encourage use of transit and high-occupancy vehicles, and increase service to areas that are currently underserved. The Plan identifies centers served, corridors, technology options, costs, and transportation system impacts centered around rapid transit system alternatives. If adopted, the rapid transit system would be built over the next thirty years, with initial operation beginning around the year 2000.

Elements of the System Plan

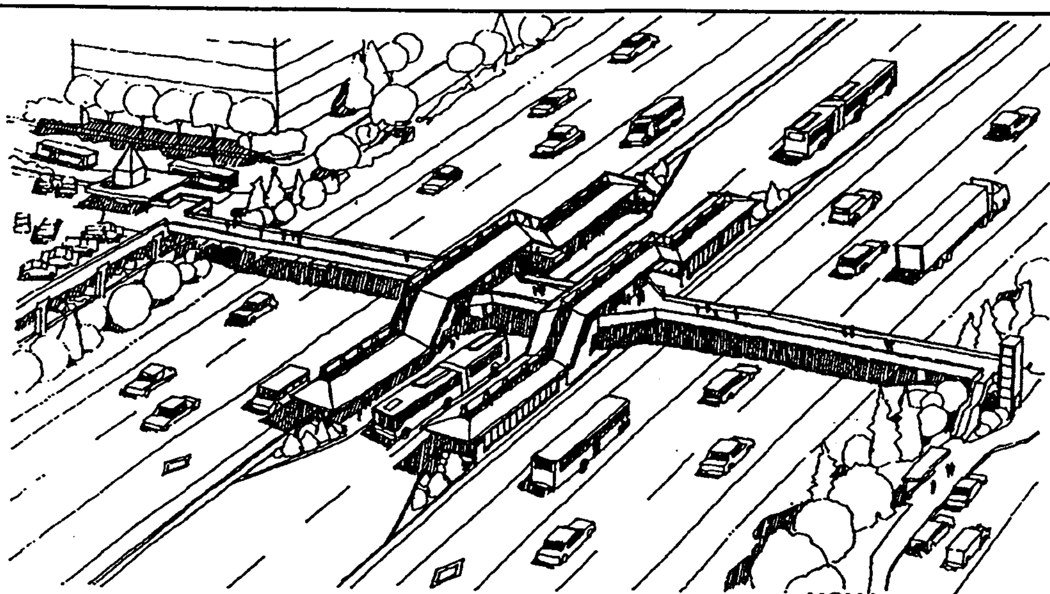
The System Plan is based on a partnership among the existing transit agencies, WSDOT, and the Regional Transit Authority (RTA) to be established under Chapter 81.112 RCW. A mix of funding sources and service strategies is assumed. The System Plan has five main elements. The first is restructuring and expanding bus service. Bus transit service in the three-county region would increase by 40 percent in the first 10 years and almost double by the year 2020, with the initial increases taking place within the first year of voter-approved financing. The expanded bus service would be designed to provide all-day connections throughout the region. Direct regular regional service would be provided between activity centers. Increased regular and on-call, all-day service would be provided from urban and suburban neighborhoods to activity centers. Service would also be provided within activity centers to make it possible to travel easily throughout the region by public transit throughout the day.

The second plan element is to improve transit system integration and access. Improvements would be made to local streets to increase transit speeds, schedule reliability, and convenience. Access to transit would be improved for everyone, including people with disabilities. Bicycles would have access to the transit system and bicycle storage facilities would be improved and expanded.

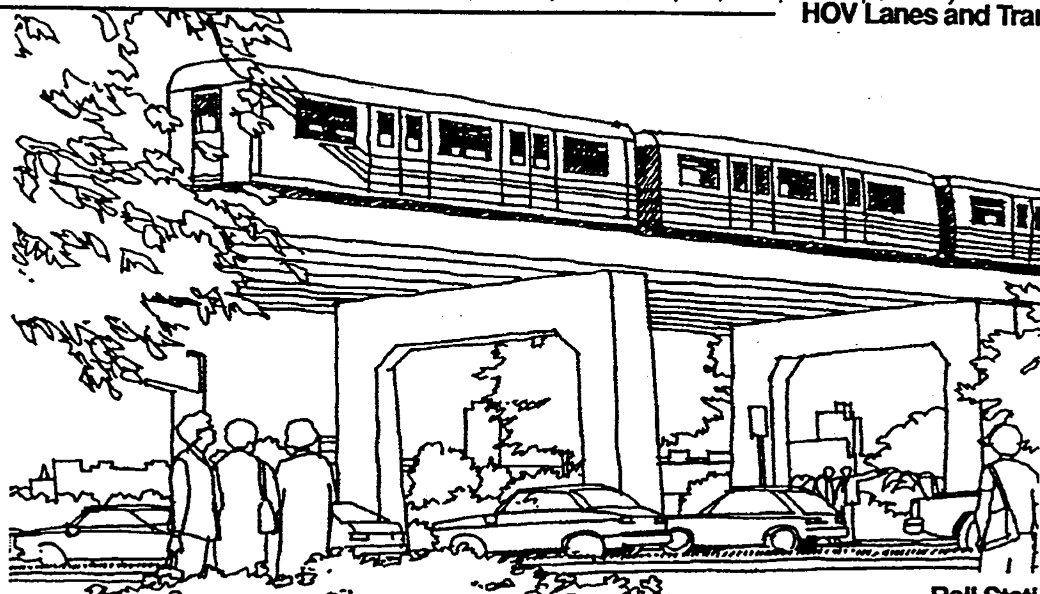
The third plan element is completing the regional high-occupancy-vehicle (HOV) system planned by WSDOT, providing measures to give HOVs (buses, vanpools, and carpools) priority on congested major arterials, and expanding park-and-ride lot facilities. This plan element would increase public transit efficiency and reliability by taking buses out of congested general-purpose traffic lanes. It would also provide a travel time incentive for using carpools, vanpools, and bus transit, and would support local governments' and employers' transportation demand management plans. Accelerated implementation of the HOV element of the plan would require a partnership between WSDOT and transit agencies, in addition to a policy decision by local governments and transit agencies authorizing funding for an expedited program. The amount of RTP funding, if any, in the HOV lanes is still being discussed by the JRPC and will be decided prior to finalization of the plan.

The fourth plan element involves creating a partnership between transit agencies, local governments, communities, and private investors whose job will be to develop economically viable pedestrian-oriented transit centers and corridors. Successful centers and corridors will have a more intense mix of commercial, office, and multi-family development and be conducive to nonmotorized and transit access. Elements that create a pedestrian-friendly environment include pedestrian walkways, bicycle lanes, crosswalks, pedestrian-controlled signals, lighting, planted medians, tree-lined streets, and transit preferential amenities.

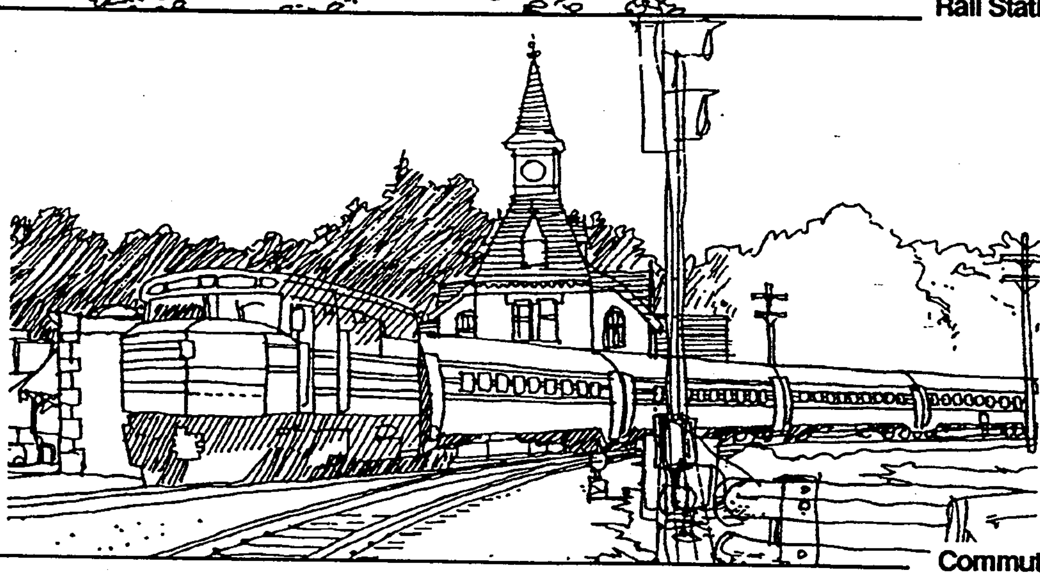
The fifth plan element is a regional rapid transit system, with either buses running on a combination of HOV lanes and transitways (physically divided lanes for buses and carpools) at critical choke points or a regional rapid rail system, supplemented by a commuter rail line in the Green River Valley (Figure 1). (Unless otherwise indicated, "rail" in this document refers to the rapid rail system and not to commuter rail.) Using separate rights-of-way with limited stops would let transit users travel between the region's centers at speeds comparable to or better than the private automobile without the



HOV Lanes and Transitway



Rail Station



Commuter Rail

Regional
Transit
Project

KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

RTPCC4

Typical High Capacity Transit

System Plan EIS

FIGURE 1

automobile's environmental costs. The result would be increased mobility for those choosing transit.

Crucial to the success of the plan are the ongoing efforts to manage growth in the region under the Growth Management Act and to reduce commuter trips under the Commute Trip Reduction law. Planning under the Growth Management Act will concentrate new growth into urban centers and provide the infrastructure to serve that growth, generate a higher ridership for public transit, and incorporate measures to favor transit and HOVs. Implementation of the Commute Trip Reduction law will also cause a reduction in SOV trips and an increase in transit ridership, HOV use, and nonmotorized travel.

Alternatives

The System Plan Final Environmental Impact Statement (FEIS) identifies and compares the environmental impacts of three alternatives for investing in transit facilities and service, as well as a No-Build Alternative that serves as an environmental baseline. While all three build alternatives represent similar bus service increases, they represent different philosophies and cost levels for improving regional transit and its associated land and environmental conditions. Under all three build alternatives, there would be efforts to increase bus speed and efficiency, transit-friendly land use, and the percentage of transit, HOV, and nonmotorized trips.

- The TSM Alternative represents improved transit efficiency that can be achieved by completing the regional high-occupancy-vehicle (HOV) system, adding significant HOV improvements to regional arterials, and greatly expanding park-and-ride lot capacity. It is the lowest-cost alternative at 3.5 billion dollars more than the No-Build Alternative.

- The Transitway/TSM Alternative would provide exclusive busways and transitways, physically separated for buses and carpools, in the region's core in addition to the improvements planned under the TSM Alternative. At 4.3 billion dollars more than the No-Build Alternative, it is the intermediate-cost alternative.

- The Rail/TSM Alternative provides an extensive regional rail system along with most of the proposed TSM Alternative's service and capital improvements. It is the most expensive alternative at 10.3 billion dollars more than the No-Build Alternative.

Environmental Process

The System Plan is a programmatic document and is being reviewed as such under the State Environmental Policy Act (SEPA). Project-level EISs for rapid transit and for the related TSM capital improvements will supplement this programmatic review when and if voters approve the System Plan. Corridor environmental work will meet both SEPA and National Environmental Policy Act (NEPA) requirements. SEPA encourages agencies to review general programs in broader environmental documents, with subsequent documents concentrating solely on project-specific issues. Analysis in this programmatic EIS will be used to screen alternatives considered in subsequent environmental review.

Purpose And Need

The System Plan presents an effective mass transit alternative to problems associated with automobile use in the three-county region. It has also been developed in response to on-going analyses of land use and transportation issues, as well as a voter-approved advisory measure in King County in 1988, which called for expediting the planning of a regional rapid transit system. Implementing the System Plan by itself will not solve congestion on the region's freeways and arterials or environmental problems associated with automobile use. However, it will effectively provide improved mobility for people throughout the region by expanding peak period capacity and providing an alternative to the use of SOVs on the congested freeway network. The recommended System Plan proposes the following measures to increase the efficiency and effectiveness of public transit:

- complete the HOV system
- improve bus access to the HOV system
- identify and remove "choke points" for transit by giving buses priority at those points
- improve the public transit infrastructure (e.g., HOV lanes)
- substantially expand bus service
- build a regional rapid transit system.

The Problem

Transportation has become a critical concern in the central Puget Sound region. The transportation system is closely linked to other issues that define our quality of life - patterns of land uses and open spaces, air quality, aesthetics, housing affordability, and housing and employment accessibility. In turn, land use practices have played a major role in creating dependence on SOVs.

Three types of transportation problems are common in the central Puget Sound region:

- *Congestion* constricts travel on most major freeways, expressways, and arterials.

- *Slower and less predictable travel times* result from congestion.

- *Transit and HOV modes are caught in congestion*, too, and therefore cannot offer a competitive alternative to the SOV, aggravating the more apparent problems of congestion and slower travel.

The existing HOV system provides limited benefit because it does not provide a continuous network that is separated from general-purpose traffic. Because it is fragmented and has limited transit access, the existing HOV system offers little or no speed advantage for public transit operations over SOVs in most cases. Furthermore, transit routes usually do not provide convenient, timely connections to outlying destinations.

Today's problems evolved from a lack of investment in major transportation facilities and operations while the amount of travel soared:

- Residential development and employment sites have spread outward at an accelerating rate, accompanied by a continued trend toward lower density development. These trends have contributed to growth in travel

demand and an erosion of the effectiveness of alternative transit investments.

- o Lower-cost investments for managing travel demand - such as ridesharing and expanded bus service - have been of limited benefit because they are constrained by congested roadways.

In the past 25 years, several comprehensive transportation plans have been prepared that recommended transportation investments for the central Puget Sound region. Each plan anticipated the major transportation problems faced by the region today: severe congestion, declining travel speed, and a lack of transportation alternatives. Generally, however, the major improvements necessary to counter these problems have not been made because of political and economic considerations. These include 156 miles of freeways proposed in the 1967 *Puget Sound Regional Transportation Study*, a 97-mile rapid transit system recommended in the *Forward Thrust* plan in 1968, and 87 miles of freeway and 89 miles of transitways proposed in the 1974 *Transportation Plan for the Puget Sound Region*. Subsequent to the issuance of the recommended draft System Plan, WSDOT estimated that it would cost approximately 14 billion dollars to provide the same mobility as the transit plan by expanding existing freeways.

Furthermore, travel in the region today far exceeds the volume projections made in former transportation plans. Several trends have contributed to the growth in travel (PSCOG 1990):

- o Population and employment growth caused a dramatic increase in the number of trips.
- o Dispersed land-development patterns increased the average distance traveled to work.
- o Automobile ownership increased 108 percent between 1970 and 1990, contributing to a drop in the number of people riding together to make a trip and an increased number of vehicular trips.
- o Two-income households and multipurpose work trips have increased, changing the patterns and direction of peak-hour travel demand.

Today, we travel more often, over longer distances, and with fewer people than in the past. All of these trends have overburdened the transportation system.

Between 1990 and 2020, the central Puget Sound region is projected to experience a 52 percent increase in population and a 57 percent employment growth. Traffic is projected to increase by 78 percent (PSCOG 1988).

Since 1970, transit service and ridesharing have been used to stretch roadway capacity by reducing the number of vehicles required to carry a given number of people. While the service investments have been effective, they have not been enough. Though transit and vanpool ridership has doubled since 1970, the 1990 transit and vanpool capacity represented a smaller portion of total daily travel than in 1970 (PSCOG 1990).

Capacity

Higher capacity facilities, such as HOV lanes and rapid transit, are more effective in moving high volumes of people than general-purpose roadways. *Freeway lanes* remain effective up to volumes of about 2,000 vehicles per hour passing a single point. This capacity is reduced when roadways have closely spaced on- and off-ramps, curves, steep grades, or other constraining features. With an average of 1.2 persons per vehicle, one general-purpose freeway lane can effectively carry up to 2,400 people per hour.

Depending on the mix of vehicles (buses, vanpools, and carpools), an *HOV lane* has a range of capacities, depending on location, separation, and access and egress facilities. A protected HOV lane used primarily by buses could carry over 9,600 people per hour. However, if this theoretical capacity is adjusted to reflect speed advantage, expected capital investment, and vehicle mix and occupancy expected for purposes of modeling, HOV lanes in the region can be expected to carry between 4,800 and 5,700 persons per hour, depending on minimum vehicle occupancy requirements.

The theoretical per direction capacity of a *busway*, or barrier-separated lane for exclusive use for buses, is approximately 22,000 persons per hour in one direction past a single point. However, this theoretical capacity would require a level of transit service and capital investment much higher than that represented by the Transitway/TSM Alternative studied in this FEIS. Adjusting for these factors, the transitway lanes in the Transitway/TSM Alternative can reasonably carry up to 9,400 persons per hour in buses, vans, and HOVs.

A *rapid rail* line operating in exclusive right-of-way has the theoretical capacity to carry over 22,000 persons per hour in each direction past a single point. These numbers represent the rail capacity of the downtown Seattle transit tunnel; capacity would be higher in segments with less frequent station stops. In comparison, the bus passenger capacity of the downtown tunnel is about 13,400 persons per hour in each direction.

Right-of-Way

The land displaced by alternatives carrying higher-capacity vehicles would be less than the comparable displacement needed to increase freeway capacity for general-purpose traffic (Table 1). To move 22,000 people per hour, a *freeway* carrying general-purpose traffic would require 18 lanes (9 in each direction). This requires approximately 270 feet of continuous right-of-way, expanding to well over 300 feet for access and exit ramps.

Table 1. Right-of-Way Required to Move 22,000 People per Hour.

Type of Facility/System	Right-of-Way Required (feet)
Freeway with general-purpose lanes	270
Freeway with one 3+ HOV lane in each direction	246
Exclusive Busway	47
Rail	40

A freeway that includes an HOV lane in each direction requires 16 lanes or 246 feet of continuous right-of-way. (At current levels of carpool use, one HOV lane in each direction would have enough capacity for all the HOVs on the freeway.) An *exclusive 2-lane busway* would require about 47 feet of

right-of-way, expanding to 72 feet or more at stations. A *rail line* would require about 40 feet of continuous right-of-way, expanding to 60 feet or more at station areas.

Air Pollutants

The alternatives that best accommodate higher-occupancy vehicles have the greatest potential to reduce energy dependence and decrease vehicular emissions. In 1990, motor vehicles in the region generated about 70 to 75 percent of all carbon monoxide emissions and 80 percent of all particulate emissions polluting the region's air. Although passenger car emissions per vehicle mile have decreased significantly since the 1970s, growth in total vehicle miles traveled has diminished the air quality benefits of cleaner cars and is expected to contribute to increased aggregate vehicular emissions within the next 10 to 15 years. In 2020, a person driving alone in a gasoline-powered car will generate approximately 12 grams per mile of carbon monoxide, more than 100 times the average per passenger emissions of a natural gas bus (at the current average occupancy of 11 persons, including deadhead miles). The same person would generate approximately 2.5 times as much nitrogen oxides and 13 times as much hydrocarbon emissions as expected average per passenger emissions of a natural gas powered bus. Estimated average exhaust particulate emissions per person for a gasoline-powered SOV and a natural-gas powered bus would be roughly equivalent.

Energy

Similarly, the person traveling in an SOV requires about 6,200 BTUs of energy per mile; about 2,067 BTUs of energy by 3-person carpool; and about 3,775 BTUs of energy in a 40-foot bus with an average load. At peak periods, however, transit vehicle energy efficiency becomes two to three times better because of increased passenger loads.

Land Use

The State Growth Management Act (Chapter 36.70A RCW) requires consistency and coordination between land-use planning and transportation planning. The act promotes higher-density development in the urban parts of the region and discourages growth beyond the urban boundary. Freeways and similar facilities aimed primarily at serving automobiles promote a dispersed, low-density growth pattern, particularly on the fringes of the urban area. Bus and, to an even greater extent, rapid transit facilities can contribute to more concentrated employment and residential densities than new freeways and arterials. In areas where there is efficient mass transit, supported by appropriate land use, zoning, and other policies, businesses and residents cluster near transit facilities. In turn, bus and rapid transit facilities are most successful where there are relatively high-density employment and housing areas. Growth management, as mandated by the state legislature and developed in *Vision 2020*, encourages a change of emphasis away from SOVs in the new transportation facilities developed in the future.

Public And Agency Review

Shaping the System Plan has involved active agency and public participation. There will also be many future opportunities for agency and public

involvement and review during subsequent environmental review of system design, construction and implementation phases.

To date, the public involvement program has included four series of public forums, numerous meetings with community and business groups, discussions with special interest groups, and public hearings on the scope of the environmental review and on the Draft EIS (Figure 2). In addition, RTP funded a group composed of representatives of a number of citizen's groups, known as the Sounding Board, to provide additional input into System Plan development. The JRPC and the transit agencies received comments and summaries from these meetings. Section 1.9 gives a detailed summary of the public involvement program to date.

Other agencies have been involved in developing and reviewing the alternatives. These have included:

- a regular technical forum for agency staff
- participation by RTP staff in regional transportation planning bodies
- meetings with staff of most of the local jurisdictions in the RTP planning area.

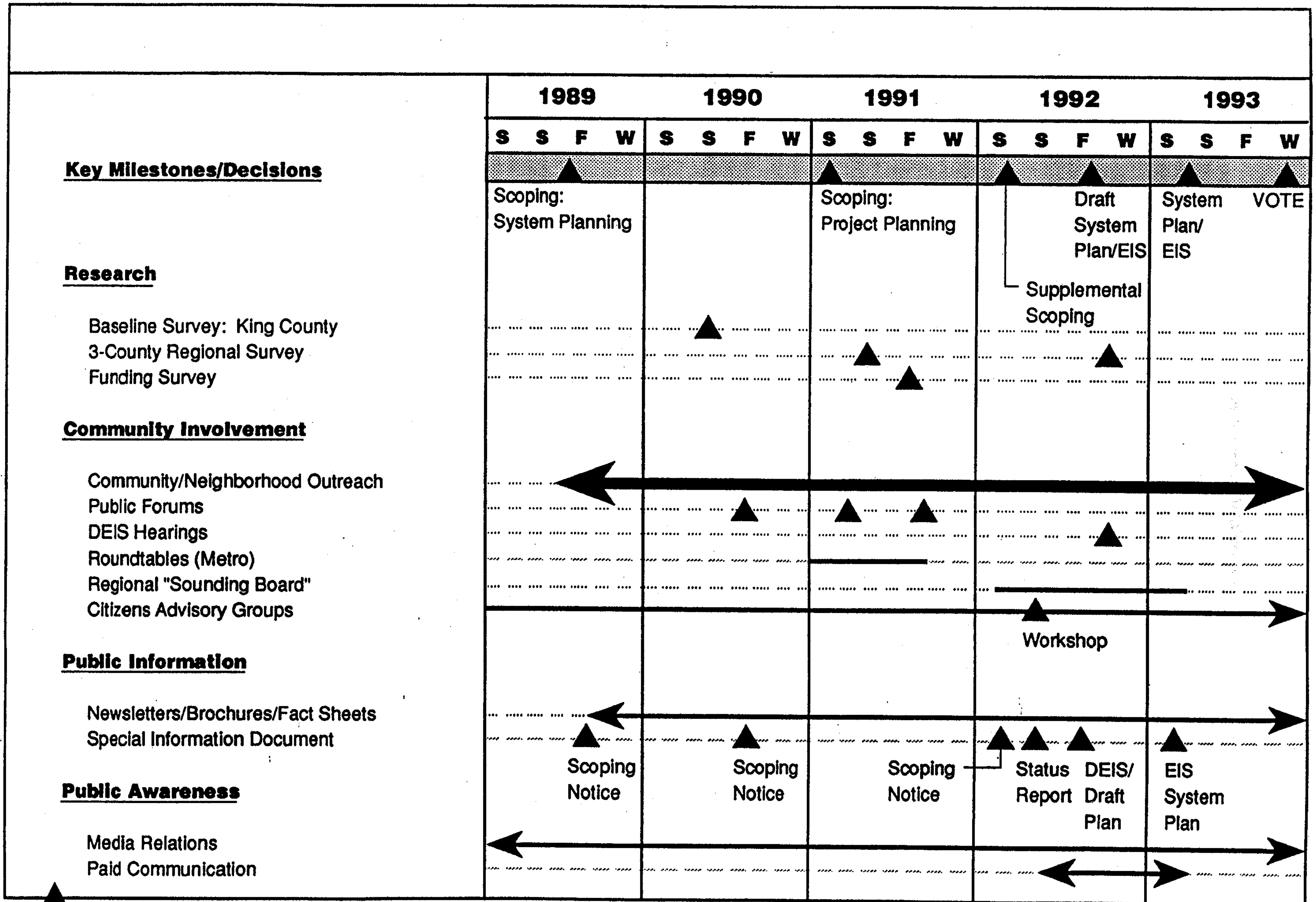
Agencies formally commented on alternatives as part of Vision 2020, Metro Long Range Plan, Metro 2000 plan, Snohomish County Public Transportation Plan, and Pierce County Transportation Plan scoping processes. Supplemental scoping for the System Plan was carried out in May and June of 1992. Hearings on the Draft EIS took place in November 1992.

Planning has been carried out in three main corridors: the North Corridor, including the portion of King County north of downtown Seattle and west of Lake Washington and Snohomish County except for the I-405 corridor; the South Corridor, including Pierce County and the portion of King County south of downtown Seattle and west or south of Lake Washington, and the East Corridor, including King County east of Lake Washington and north of Renton, as well as the I-405 corridor in Snohomish County.

North Corridor

Coordination with jurisdictions in the North Corridor takes place through several regional bodies. In Snohomish County, SNO-TRAN is the primary review body for the Snohomish County portion of the North Corridor's RTP plan. Staff and policy makers meet frequently with several groups in Snohomish County, including:

- NEXT TAC, SNO-TRAN'S technical advisory group for station area studies and system planning
- the Snohomish County JRPC Advisory Group
- Snohomish County Tomorrow, which is responsible for coordinating growth management planning
- TRANTEC, an interjurisdictional technical advisory group putting together a county-wide transportation plan
- the Snohomish County Planning Directors
- the Joint Board Meetings of SNO-TRAN, Community Transit, and Everett Transit
- the Lynnwood Legacy, a joint project to develop a comprehensive plan for Lynnwood
- the Snohomish County Committee for Improved Transportation.



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Public Involvement/Awareness Program

System Plan EIS

FIGURE 2

In King County, RTP staff has facilitated work sessions, made presentations, and given periodic updates to the University District Citizens' Advisory Committee, the Northgate Citizen's Advisory Committee, the Washington State Department of Transportation, the City of Seattle Long Range Planning and Engineering Departments, and King County staff. Representatives from the Seattle Office for Long Range Planning regularly attend RTP community outreach meetings. King County and RTP staff have held review meetings on such issues as transit service and park-and-ride facilities in the unincorporated areas of the North Corridor within King County.

South Corridor

Progress on the System Plan, and its predecessors Metro 2000 and the Long Range Plan, has been reviewed by South Corridor local jurisdictions' staff through:

- participating in region-wide workshops defining rail and transitway alternatives early on in the project
- attending presentations to community groups and elected officials made by RTP staff.

In addition, RTP staff have reviewed study assumptions and schedules with the staff of local jurisdictions affected by the alignment options and with existing transportation study groups in the South Corridor. RTP staff have met with the staff of the cities of Seattle, Tukwila, Renton, SeaTac, Federal Way, Kent, Auburn, King County, Pierce County, the Port of Seattle and the Washington State Department of Transportation. RTP has met transportation study groups, including the South Access Advisory Board and the South King County Transportation Board.

East Corridor

Coordination with jurisdictions in the East Corridor has included:

Eastside Transportation Plan. The Eastside Transportation Plan (ETP) was formed in 1987 to coordinate, help reach a consensus about, and implement a major multiple-project multijurisdictional transportation improvement plan for the eastside. By agreement between mayors of eastside cities and RTP project managers, ETP is the primary review body for the East Corridor's RTP planning process. All RTP information and recommendations are funneled through the ETP for review and concurrence before being presented to the transit agencies and the JRPC. ETP membership includes WSDOT, the State Transportation Improvement Board, the Puget Sound Regional Council, Metro, King County, Snohomish County, and the cities of Mercer Island, Bellevue, Kirkland, Issaquah, Renton, Redmond, and Bothell.

East Corridor Workshops. The RTP has held workshops with the cities of Bellevue and Redmond planning staffs to review proposed rail and transitway alignment alternatives in the two communities and jointly in the Overlake area. The workshops helped screen out alignment alternatives that did not appear to warrant more study.

Meetings and Field Surveys with Agency Staff in the East Corridor. RTP staff met with the staffs of the cities of Issaquah, Bellevue, Redmond, Kirkland, Mercer Island, and Bothell. At these meetings, RTP staff presented an overview of the planning process to date and, except for Mercer Island, toured each city and its potential alignments.

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Meetings with Eastside Elected Officials. RTP staff has presented information on the System Plan through formal presentations before various city councils and through individual briefings with eastside mayors and council members.

Current and Future Coordination

Along with issuing this FEIS, the JRPC has made and will be making recommendations about the draft System Plan, including:

- More bus service options
- Alignment alternatives in selected areas
- Transit mode
- Funding alternatives
- Neighborhood links to the regional system
- Implementation staging or phasing.

Citizens' comments on each of the issue areas have been summarized and provided to the decision makers during their deliberations. Public involvement has continued during the review of the Draft Environmental Impact Statement and development of the FEIS. Following the issuance of the FEIS, adoption of the final System Plan, and formation of an RTA, the System Plan, including a financing plan, will be presented to the voters for approval in November 1993. The public involvement process will continue during the project-level environmental review, conceptual engineering, and predesign analysis phases of the project. Staff will continue working with the agencies to resolve alignment and station issues and other capital and service improvement issues in their jurisdictions. Assuming passage of a financing proposal, local and state agencies, as well as the public, will maintain involvement through corridor-level planning and hearings; hearings on the project-level EIS(s); design hearings and meetings for specific alignments and station locations as appropriate during station-area planning; and meetings throughout the construction process.

Scope of EIS

This Environmental Impact Statement (EIS) is part of a "phased" environmental review process. Phased review is designed to assist agencies and the public to focus on issues that are ready for decision and exclude issues already decided or not yet ready for decision. Phased review begins with broader programmatic or nonproject environmental documents that are generally followed by narrower, site-specific or project-level documents. The project-level documents usually incorporate prior general discussion by reference and concentrate solely on the issues specific to that phase of the proposal.

Because of the System Plan's complexity, geographical extent, and time frame, several phases will be necessary before environmental review is complete. Beginning with the current programmatic review, analysis will proceed into project-level review. Project-level review will analyze in detail the alternative adopted during the system planning process, either by corridor, or beginning with a "core" system of improvements. In some cases, more specific projects with early implementation dates, such as commuter rail or Transportation Systems Management (TSM) improvements, will receive project-level review before or at the same time as other project-level environmental review. Specific alignments for the alternative adopted at the system level will be selected during project-level review. Analysis then

proceeds into site-specific preliminary engineering and design along with further coordination with agencies and meetings with the public. Projects not covered by these analyses would be analyzed in project-level documents later in the project, again with subsequent preliminary engineering and design review.

This EIS is a programmatic, nonproject EIS. As such, it evaluates the potential broad System Plan impacts. The EIS reviews impacts and alternatives at a detail level consistent with the issues addressed in the System Plan. In most instances, the EIS identifies possible adverse impacts of the alternatives at a regional level. Even when specific alignments are discussed, impact consideration is generic. The understanding is that additional analysis of impacts and recommended mitigation measures will be done later during project-level environmental review after a system alternative is adopted. Table 2 compares the scope of analysis of the System Plan EIS with that of subsequent project-level review for specific issue areas.

Table 2. Comparison of Programmatic and Project-Level Scopes of Environmental Analysis.

Subject Area	System Plan EIS	Project-Level Review
Transportation	Regional traffic levels and modes Regional transit ridership and accessibility Regional mobility and travel times	Traffic levels on specific roadways Ridership/accessibility to centers Mobility/travel times between specific centers
Air Quality	Regional air pollutant loadings	Air quality at critical locations
Noise	Typical noise and vibration impacts	Specific noise and vibration impacts
Water Quality/ Hydrology	Regional changes in runoff Regional pollutant loadings (qualitative)	Runoff to specific water bodies Specific pollutant loadings
Ecosystems	Potential wetlands affected Potential types of impacts and mitigation	Specific wetlands affected Specific wetland impacts and mitigation
Energy	Approximate comparative energy requirements	More specific energy requirements
Environmental Health	Potential hazardous waste sites affected	Specific impacts on hazardous waste sites
Visual Quality	Typical visual impacts of the alternatives	Specific visual impacts
Land Use and Economics	Consistency with regional and local plans Impacts on regional economics Typical/regional land use impacts	Consistency with regional and local plans Impacts on specific businesses Impacts on specific local land uses
Parks and Recreation	Potentially affected parks	Specific park impacts
Historic/Cultural Resources	Potentially affected resources	Specific impacts on historic and cultural resources

A recommended draft System Plan was issued at the same time as the DEIS. Copies of the draft System Plan are available from Metro. An address,

telephone number, and contact person are provided in the Fact Sheet at the beginning of this document.

Guide to the EIS

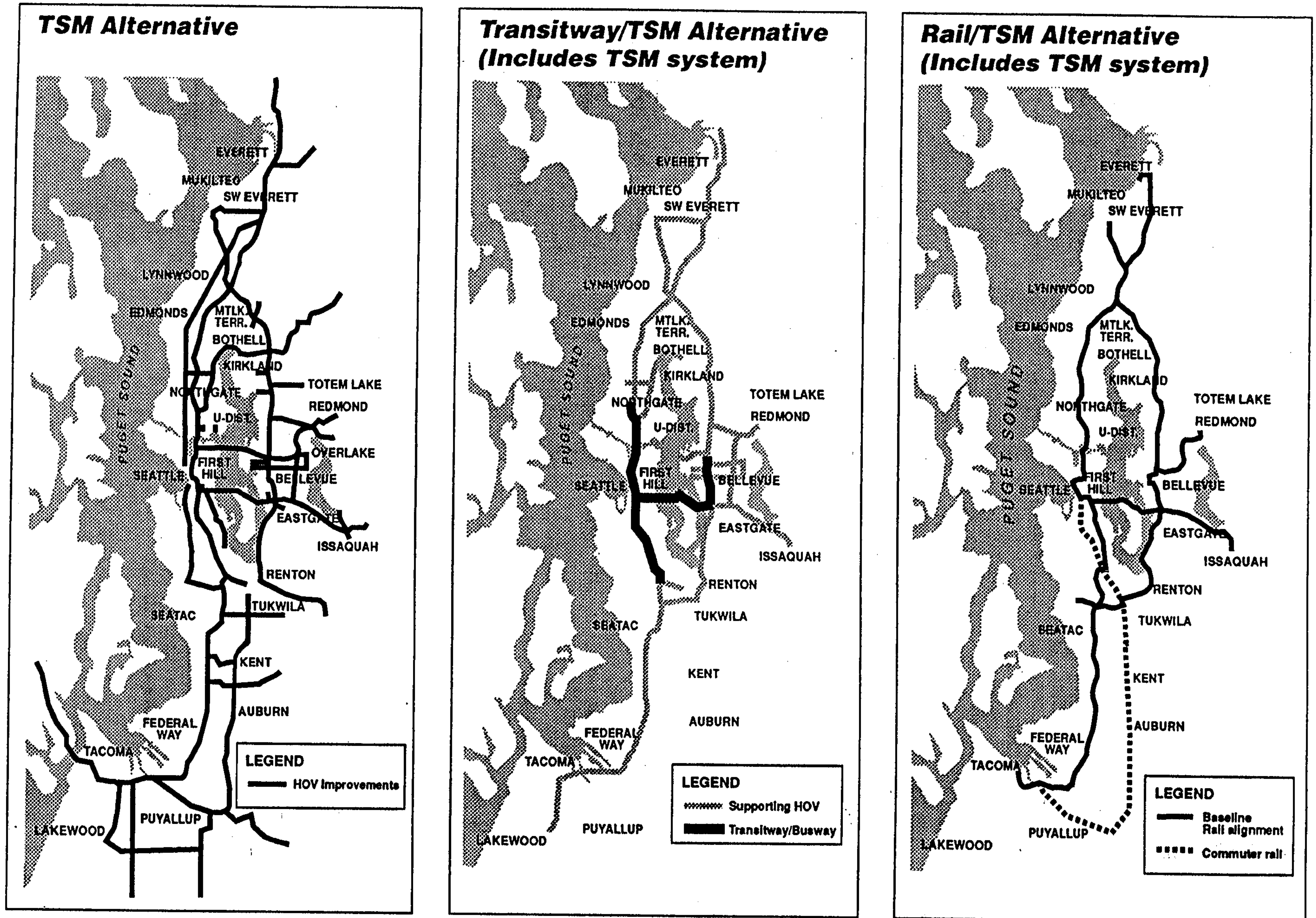
The EIS is divided into five chapters. The first chapter, the introduction, gives the background of the project, public involvement, the decisionmaking process, and the purpose and scope of the environmental review. The second chapter describes the alternatives under consideration and potential supplements. It also discusses other alternatives that have been proposed and explains why they are not being analyzed in detail here. The third chapter analyzes the environmental impacts of the alternatives at a programmatic level, by element of the environment. Each section of the third chapter discusses an element of the environment as it exists today, the impacts on that element of building each of the alternatives (construction impacts), the impacts of operating the transit system under each of the alternatives (operations impacts), and measures that could be taken to mitigate adverse impacts. The final section in Chapter 3 summarizes adverse impacts of each alternative that would be difficult or impossible to mitigate. Chapter 4 discusses consistency of the alternatives with on-going growth management planning in the region. Chapter 5 summarizes comments received on the draft EIS.

Alternatives

The No-Build Alternative provides a baseline for evaluating the *environmental* impacts of the build alternatives. Three build alternatives are considered: The stand-alone Transportation System Management (TSM) Alternative has been defined to provide a baseline for evaluating the *cost-effectiveness* of the more capital-intensive Rail/TSM and Transitway/TSM Alternatives. The TSM Alternative also defines a basic transit service network and set of roadway improvements that would be implemented - with modifications - as a part of either the Transitway/TSM or Rail/TSM Alternatives. The Transitway/TSM Alternative is an intermediate-cost alternative that adds barrier-separated busways and transitways in the region's core to the TSM improvements. The Rail/TSM Alternative provides an extensive regional-rail system with most of the service and capital improvements proposed for the TSM Alternative (Figure and Table 3).

Services and facilities would be provided by a variety of agencies using a variety of funding sources. For example:

- Freeway HOV lanes would be built and operated by WSDOT using federal, state, and local funds.
- HOV improvements off the freeways would be jointly developed by local jurisdictions, WSDOT, and the transit agencies with funding from state, federal, and local sources.
- Supporting bus services would be the responsibility of the local transit operators and paid for out of available transit revenue sources.
- Rapid transit services and related facilities would be provided by a Regional Transit Authority (RTA) and funded with voter-approved tax revenues, federal funds, fares, etc.



This shows the baseline alignments used for modeling. Other alignments are being considered.

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System Plan Alternatives

System Plan EIS

FIGURE 3

Table 3. Components of the Three Build Alternatives.

	Alternative TSM	Alternative Transitway /TSM	Alternative Rail/TSM
Capital Projects to Improve Regional Service			
New Freeway HOV Lanes	384 Lane Miles	384 Lane Miles	384 Lane Miles
Highway and arterial HOV and transit improvements	Yes	Yes	Yes
Transitway System	No	Yes	No
Rail System	No	No	Yes
Commuter Rail Line from Seattle to Tacoma	No	No	Yes
New Stations	0	10	78
New Park-and-Ride Stalls	14,000	14,000	38,000
New Bus Maintenance Bases	4	4	3
Regional Service Improvements			
Expanded system of regional express bus routes	Yes	Yes	Interim Only
Rail system service	No	No	Yes
Commuter rail service from Seattle to Tacoma	No	No	Yes
Local Service Improvements			
Expanded local/express bus routes and service	Yes	Yes	Yes
Expanded local feeder bus service	Yes	Yes	Yes
Expanded demand-responsive service	Yes	Yes	Yes
Expanded service for elderly and people with disabilities	Yes	Yes	Yes
Expanded vanpool program	Yes	Yes	Yes
Bicycle/Pedestrian Improvements			
Improved bicycle access to transit	Yes	Yes	Yes
Increased bicycle transport on transit	Yes	Yes	Yes
Increased pedestrian amenities and access at transit hubs and along transit corridors	Yes	Yes	Yes

While each of the three build alternatives has a somewhat different approach to regional services, community bus services would be similar. Community bus services would be expanded to provide all-day service throughout the region's urbanized areas, either through fixed routes in higher-density areas and with demand-responsive services and service to park-and-ride lots in lower-density areas. Community bus service would be structured to provide good connections to the regional transit system. Similarly, transit would play an increased role in vanpooling by substantially enlarging vanpool fleets under all the alternatives.

The choice of a recommended system will be based on a variety of criteria, including:

- effectiveness in increasing mobility

- the 2020 and phased system alternatives' cost and efficiency
- social, economic, and environmental impacts
- effects on regional equity
- financial feasibility
- consistency with the Vision 2020 plan.

Specific kinds of evaluation measures include:

- capital costs
- system ridership
- percentage of trips by transit, vanpool, or carpool
- travel time savings
- miles and hours traveled per day per person
- transit speed and reliability
- links between employment and residential areas
- ease of off-peak travel
- the farebox revenue that can be expected in relation to costs
- operating and maintenance costs
- ability to operate effectively in the built environment
- support for creation of pedestrian- and transit-friendly communities
- cost-effectiveness
- geographic and socioeconomic equity
- impacts on land use
- use of energy
- effect on air pollutant emissions
- environmental impacts
- affordability.

The System Plan alternatives represent a range of transit investment options over the next thirty years. Each alternative includes a basic network of transit services and facilities, a particular technology emphasis, and an emphasis on service between urban activity centers. All three build alternatives aim to improve public transit service throughout the region, including improved connections between neighborhoods and regional centers, and among regional centers. The three build alternatives are also designed to significantly improve the speed, reliability, and frequency of transit service throughout the region during both peak and off-peak service hours. The System Plan also anticipates that the increase in transit investment will be carried out with transit-compatible land use planning around stations and transit centers.

The System Plan anticipates an increase in demand for public transit due to adopted governmental policies:

- The state *Growth Management Act* requires transportation plans to be consistent and coordinated with comprehensive plans. Concurrency requires that needed transportation facilities or strategies be in place at the time of development or within six years in order for development to proceed.

- New regulations for *transportation demand management* will require major employers to significantly decrease the percentage of employees using SOVs by using incentive and disincentive programs.

- Implementation of *Vision 2020* and countywide planning policies will increase employment and residential densities in the three-county area

and will increase the use of public transit and carpools rather than single-occupant vehicles (PSCOG 1990).

- New federal requirements in the *Americans with Disabilities Act* (ADA) will also increase the demand for public transit and requirements for provision of such services.
- New federal and state *clean air* requirements will require measures to limit automobile miles traveled and increase transit use and ridesharing.

The specific proposals included in each build alternative are the product of an extended and intensive period of conceptual engineering, public involvement, and local jurisdiction coordination. Adopted and proposed transportation plans were also examined and key points for improving transit and HOV speeds and effectiveness were identified. The alternatives as defined were approved by the sponsoring transit agencies, the Joint Regional Policy Committee, and the Expert Review Panel.

No-Build Alternative

The No-Build Alternative limits capital investment by regional transit agencies to that necessary for maintaining existing service. Transit fleet levels would remain about the same, except for Pierce Transit's fleet, which would be reduced by about 10 percent because of a lack of funds and the need to substantially increase special programs, such as services to the disabled population. The No-Build Alternative also assumes a baseline roadway network, which is defined as the existing roadway network plus significant roadway projects that jurisdictions are currently building or have funding available to complete. The baseline roadway network includes budgeted portions of WSDOT's HOV lane program that are expected to be built by 1993. The baseline roadway network excludes unbudgeted portions of the network, even if they are included in future plans. The transit system associated with the No-Build Alternative would consist of the existing 1991 transit network. Except for currently funded park-and-ride and transit lot expansions, the No-Build Alternative would not require building new transit maintenance or operating facilities beyond existing facilities. The capital cost of the No-Build Alternative would be about 1.2 billion dollars.

The No-Build Alternative is an unrealistic alternative, in the sense that, regardless of the decision made on System Plan proposals, transit service levels are likely to grow over the next thirty years. Historically, transit revenues have grown by about two percent per year. In fact, two of the transit operators (Community Transit and Everett Transit) have adopted plans that indicate substantial increases in transit service in the future (see Section 1.8). However, the No-Build Alternative serves as the baseline for evaluating the environmental impacts of the other alternatives. It will be carried forward into project-level evaluation to meet Federal Transit Administration (FTA) requirements for evaluating alternatives. The FTA guidelines define the No-Build Alternative as including only budgeted programs. As required by FTA guidelines, all elements of the No-Build Alternative are also part of each of the other alternatives.

Transportation Systems Management (TSM) Alternative

The TSM Alternative emphasizes nearly doubling regional bus transit service, as well as capital projects to support transit efficiency, and investments in transit-friendly bicycle, pedestrian, and land use

improvements in local neighborhoods. In King and Snohomish counties, total bus hour operation would increase by almost 60 percent by the year 2020, compared to the No-Build Alternative. Total hours would increase by about 12 percent in Pierce County under the scenario used for ridership modeling. In addition, Pierce Transit is considering substantial increases in local service beyond those considered for modeling purposes. The TSM Alternative provides a transit service framework to develop more capital intensive rapid-transit proposals and serves as a baseline for evaluation of the cost-effectiveness of the other two build alternatives.

The TSM Alternative increases regional and community bus transit service to and between centers identified in *Vision 2020* for King, Pierce, and Snohomish counties. Service improvements would emphasize all-day and more frequent two-way and reverse commute service, with increased access to a regional bus system. Connections between regional centers and smaller activity centers would also increase. Improved transit centers and new park-and-ride lot spaces would accommodate the proposed service expansion.

To support this service concept, the freeway HOV network of the No-Build Alternative would be completed and expanded, adding projects to improve transit system speed and reliability. Buses and carpools would have better access to the HOV network and improved speed and reliability on key arterial roadways. Transit stations and park-and-ride lots would be expanded to improve access to the transit system and connections between routes. Pedestrian and bicycle access to the transit system would be improved. Implementation of this alternative would require coordination with WSDOT and local jurisdictions for phasing and financing.

Capital costs of the TSM Alternative would be approximately $3.5 billion dollars more than the No-Build Alternative, including about $1.3 billion to complete WSDOT's freeway HOV network.

Transitway/TSM Alternative

The Transitway/TSM Alternative evolved from earlier evaluation of a fully dedicated busway alternative developed as part of the Metro 2000 project. That busway alternative was a rapid-transit system with scope and alignments similar to those proposed in the current Rail/TSM Alternative. Preliminary capital costing and operating plans indicated that the fully dedicated busway system would have as high or a higher capital cost, a higher operating cost, and lower capacity and ridership than a comparable rail system. As such, it was considered unlikely to provide a competitive alternative to a rail proposal. In light of these conclusions, the JRPC and the Planning Subcommittee of the Metro Council directed RTP staff to develop a second all-bus alternative which would be intermediate between the TSM and Rail/TSM alternatives in terms of cost and performance. The current revised Transitway/TSM Alternative is designed to improve on the TSM Alternative while taking advantage of ways a bus-based system might be more flexible and cost-effective than a rail system.

The unique features of the Transitway/TSM Alternative are barrier-separated bus-only and bus-carpool lanes in the core of the region. The transitway would consist of three legs radiating from downtown Seattle, one to Northgate, one to Bellevue, and one to Tukwila, with buses continuing on freeway HOV lanes from the ends of the transitway into Snohomish and Pierce counties and on the eastside. Access/egress ramps would connect the transitway with stations and park-and-ride lots.

Transitway/TSM Alternative bus service levels would be about the same as the TSM Alternative, with some adjustment due to an increase in average speed of about three percent and additional service. The alternative would emphasize improvements in regional and community services with local-express and express-only operations enhancing connections to centers. These operations would be overlaid on the TSM transit, paratransit, and ridesharing measures. Express routes would run directly between park-and-ride lot facilities or transit centers by way of the transitway and HOV lanes to regional centers such as downtown Seattle, the University District, Everett, Tacoma, and downtown Bellevue. Frequent direct express service would be provided from Tacoma to Everett through downtown Seattle and from Bellevue to Everett and downtown Seattle. Local-express routes would pick up and drop off passengers in neighborhoods, serve local park-and-ride lots or transit centers, and connect to regional centers and other centers by way of the transitway and HOV network.

The Transitway/TSM Alternative builds on the TSM Alternative, taking advantage of the increased bus fleet, the 2020 regional HOV system, and the speed and reliability improvements developed as a part of the TSM Alternative. However, some projects included in the TSM Alternative are not included in the Transitway/TSM Alternative due to the duplication of function by the transitway and related improvements. Other TSM projects have been modified to complement the transitway system collection and distribution functions.

Capital costs of the Transitway/TSM Alternative would be approximately $4.3 billion dollars more than the No-Build Alternative.

Rail/TSM Alternative

The rail system in the Rail/TSM Alternative has evolved from years of evaluation and public involvement, including the conceptual rail system in *Vision 2020*. General rail system alignment screening has emphasized cost-effectiveness, operational considerations, and potential environmental impacts. Screening has taken into account comments gathered from more than two years of meetings with agencies and community groups and public forums.

The Rail/TSM Alternative proposes an extensive all-day rail system. At peak periods, trains would run every two to fifteen minutes, depending on the corridor served. In the North Corridor, the system would provide service between downtown Seattle, Capitol Hill (if the alignment recommended by the JRPC is selected), the University District, Northgate, Lynnwood, and Everett. In the South Corridor, the system would directly link downtown Seattle, Rainier Valley (JRPC recommended alternative) or the Duwamish Industrial area, SeaTac, Federal Way, and Tacoma. Service would be provided across Lake Washington from downtown Seattle to Bellevue, Redmond, and Issaquah. Another rail line would directly link Paine Field, Bothell, Kirkland, Bellevue, Renton, and Burien.

Finally, a commuter rail line, powered initially by diesel locomotives and using existing freight and passenger railroad lines, would link Seattle and Tacoma by way of the Green River Valley. Commuter rail in the Green River Valley takes advantage of the fact that existing rail lines in that area serve a number of centers that would not be otherwise served very well by

the rapid rail system. Commuter rail could be implemented at a much lower cost than a second rapid rail line in that corridor.

This alternative includes about 125 miles of rapid rail running on an exclusive, grade-separated right-of-way and a 40-mile initially diesel-operated commuter rail line. For planning and modeling purposes it has been assumed that the rapid rail system would have operating characteristics similar to recently built systems in other cities and that it would have similar environmental impacts. Within the range of other North American rail lines, the rail system that is proposed would fall into the definition of "heavy" rail, since it would have a relatively high capacity and would operate almost entirely on an exclusive guideway completely separated from automobile traffic. A major advantage of evaluating conventional rapid rail is that it has been used extensively in other North American cities and therefore the technology's advantages and disadvantages have become apparent.

Bus service improvements proposed in the TSM Alternative would be reoriented in the Rail/TSM Alternative to provide community connections to the rail system. Express bus routes would continue to run where they could provide superior service between centers. Competing bus service would be eliminated only if it was slower than rail service. Because of the large investment required to build the proposed rail system, specific TSM improvements were evaluated with respect to the degree to which they would support the system or the general system objectives. Many of the capital improvements in the TSM Alternative were not included in the Rail/TSM Alternative because they duplicated rail system functions or did not support the system goals. At the same time, the Rail/TSM Alternative expands park-and-ride capacity beyond that proposed for the TSM Alternative.

Capital costs of the Rail/TSM Alternative would be approximately $10.3 billion dollars more than the No-Build Alternative

Capital Cost Estimates and Ridership Forecasts

Table 4 summarizes the capital and operating and maintenance cost estimates, ridership forecasts, and cost-effectiveness measures for the alternatives evaluated in the System Plan FEIS. Ridership for the build alternatives was estimated conservatively, assuming no changes in adopted land-use plans. Cost per new rider applies only to the Transitway/TSM and Rail/TSM Alternatives, since the TSM Alternative serves as the baseline for this measure. It should be noted that No-Build Alternative costs for Community Transit and Everett Transit are lower than those in their adopted plans, due to the restrictive nature of the No-Build assumptions. For information on CT's and ET's adopted plans, and projections for Pierce Transit, see Section 1.8.

Environmental Impacts and Mitigation Measures

The Environmental Summary Matrix (Figure 4) at the end of this section summarizes the adverse environmental impacts, mitigation measures, and

unavoidable adverse impacts for each alternative discussed in this FEIS. As a programmatic document, only generic and regional impacts have been identified and considered. The environmental review also attempts to identify fatal flaws in the conceptual designs that have been used for costing and ridership estimation. In most cases, conceptual designs have been modified to avoid potential fatal flaws. In a few cases, as with the North Corridor transitway, potential fatal flaws have been unavoidable and are identified in this document as such. More specific impacts will be identified for alternatives carried into the project-level environmental review phase. The following is a summary of the major impacts identified for the alternatives:

Table 4. Summary of System Alternatives Characteristics.

Alternative	Capital Cost (billions of 1991 $)	Operating and Maintenance Cost (millions of 1991 $)	Daily Ridership (Year 2020)	Annual Ridership (year 2020) (millions)	Cost per Rider (1991 $)	Cost per New Rider (1991 $)
No-Build	$1.2	$274	388,500	109.4	3.67	N.A.
TSM	$4.7	$399	473,900	133.7	5.92	N.A.
Transitway/ TSM	$5.5	$406	480,000	135.4	6.36	11.39
Rail/TSM (includes Commuter Rail)	$11.5	$492	560,500	157.3	7.94	12.52

No-Build Alternative

Major impacts of the No-Build Alternative would be indirect and, to some extent, are difficult to define precisely. No beneficial impacts can be identified for this alternative. Even as need for transit service rises with increased population, employment, and traffic congestion, the speed and efficiency of transit service would continue to deteriorate. The need for transit service would significantly exceed capacity on several parts of the transit system, particularly in downtown Seattle and the University District during rush hour. Traffic would exceed roadway capacity on the majority of freeways at rush hour, with no real alternative for peak-hour travel. Reduced accessibility of existing centers would encourage auto-oriented development on the urban fringe. Land-use plans calling for limited urban sprawl and increased density in present centers would be difficult to implement, as would provisions of the Growth Management Act. The No-Build Alternative would not support efforts to implement trip-reduction and air quality-control programs. Lacking a better alternative, SOV use would increase at a higher rate than transit use, worsening air quality and increasing fuel consumption.

It should be noted that the No-Build Alternative uses restrictive assumptions regarding levels of transit service, in keeping with its definition as a baseline alternative. For more realistic assumptions about expansion of transit service in Snohomish and Pierce counties, see Section 1.8.

TSM Alternative

Beneficial Impacts. While not satisfying current state requirements of the High Capacity Transportation Act, the TSM Alternative would support measures to reduce vehicle trips, with beneficial effects on regional mobility and air quality. The TSM Alternative may also provide some support to

regional land-use plans limiting urban sprawl and increasing densities in current activity centers. Compared to the No-Build Alternative, the TSM Alternative would improve transit speeds and efficiency and generally increase transit capacity to meet demand where possible. Transit ridership would be about 20 to 25 percent higher with this alternative than with the No-Build Alternative.

Potential Adverse Impacts. The TSM Alternative's construction scale is such that there could be major regional and local construction impacts, depending on improvement phasing. Significant local impacts will be evaluated as part of project-level environmental review. TSM Alternative bus traffic levels would meet or exceed the capacity of the downtown Seattle transit tunnel and the street network in downtown Seattle at rush hour, resulting in a constraint to meeting the demand created by the TSM Alternative. Transit fleet energy use would almost double.

The TSM Alternative could have site-specific environmental impacts, such as:

- Construction of HOV lanes on existing highways would temporarily disrupt freeway and arterial traffic, causing congestion and safety hazards.
- Ramps and parking garages could be visually obtrusive to communities.
- Traffic would increase near park-and-ride lots.
- Air quality would decrease near park-and-ride lots and in congested areas, due to increased levels of traffic.
- Noise would increase near transit centers and park-and-ride lots.
- Building more park-and-ride lots and adding vehicle lanes would increase stormwater runoff.
- Building HOV facilities in some areas could disturb hazardous waste sites, historic and cultural resources, open space, and parks.
- Building HOV facilities could require relocating utility lines.

No site-specific impacts are defined at this analysis level. Mitigating these impacts would be evaluated on a project-specific basis.

Transitway/TSM Alternative

Beneficial Impacts. The Transitway/TSM Alternative would increase transit service and efficiency, increasing transit ridership by providing faster regional transit service than the TSM Alternative. This alternative would further increase transit speeds and efficiency and the viability of programs designed to reduce vehicle miles traveled in the region. Transit service on exclusive busways would be consistent with the Vision 2020 regional rapid transit proposal, although the transitway system would not be as extensive as Vision 2020's proposal. Increased emphasis on transit stations and service to centers would also support regional land-use plans for limiting urban sprawl and concentrating new growth in existing centers. Support would, however, be limited by the inability of transitway buses to provide direct service into major centers in the region.

Potential Adverse Impacts. This alternative's impacts would be generally similar to but greater than those of the TSM Alternative. The likelihood of construction impacts affecting regional traffic patterns increases. The alternative would have major effects on traffic because it would convert the I-5 express lanes from use by general-purpose traffic to an exclusive transitway for buses and carpools. Use of the express lanes as a transitway would be necessary to provide high-speed, high-capacity transit service to Northgate

and beyond into Snohomish County. Closing the express lanes would divert automobile traffic onto surface arterials and through North Seattle neighborhoods, significantly degrading air quality and increasing traffic and noise in those areas. Because of this impact, the North Corridor transitway is considered to be fatally flawed. In addition, ridership on the East Corridor transitway would be slightly lower than under the TSM Alternative, indicating that this segment of the system would not be cost-effective. As with the TSM Alternative, the numbers of buses needed to carry projected ridership would exceed the capacity of the downtown Seattle transit tunnel and of downtown Seattle surface streets, resulting in a constraint on the system's capacity.

Like the TSM Alternative, the Transitway/TSM Alternative could affect stormwater runoff quality and quantity, air quality, visual quality, utility corridors, hazardous waste sites, historic and cultural resources, open space, and parks. It could also create some noise and traffic impacts. These impacts would be mitigated on a project-specific basis. Compared to the TSM Alternative, the Transitway/TSM Alternative would increase impervious surface and stormwater runoff. Transitway ramps and aerial structures would visually affect adjacent communities. The transitway could also affect the setting of historic properties along the Burlington Northern railroad tracks south of downtown Seattle.

Rail/TSM Alternative

Beneficial Impacts. The Rail/TSM Alternative would have beneficial impacts, including greatly increasing transit service and efficiency and significantly increasing transit ridership. The alternative would provide enough capacity to meet the high end of projected transit demand. The alternative would better support transportation plans emphasizing reducing vehicle miles traveled in the region than other alternatives and would reduce the amount of energy used for transportation in the region. This could have beneficial effects on regional mobility and air quality. The Rail/TSM Alternative would also fully support regional land-use plans limiting urban sprawl and concentrating new growth in existing centers.

Potential Adverse Impacts. The scale of construction for this alternative would be much greater than for the other alternatives. There are potential regional traffic congestion impacts at certain phases in the construction process. In addition to the impacts expected for the TSM Alternative, examples of likely construction and operation impacts include:

- extensive construction impacts along rail rights-of-way, including noise, vibration, dust, and traffic
- significant impacts from construction of subway stations in urban commercial areas
- potential effects on important ecosystems such as Mercer Slough, Swamp Creek, Kelsey Creek, and major rivers
- greater right-of-way acquisition and business and residential relocation than the other alternatives - particularly for stations. The greater scale of the impact is due to the greater extent of the rail system.
- increased transit energy use, although most of the increase would be from energy-efficient electric vehicles

- potential noise impacts from aerial and at-grade structures
- visual impacts of aerial and at-grade structures
- short-term traffic impacts due to construction and, if an alignment is selected that reduces I-5 capacity by taking lanes between downtown Seattle and the University District, significant traffic and air quality impacts.
- increased development pressure around some station areas
- potential impacts on utility lines, parks, hazardous waste sites, and historic and cultural resources.

Summary of Unavoidable Adverse Impacts

Most impacts of the build alternatives could be reduced with mitigation measures. However, some impacts, usually minor, could not be mitigated. In a few cases, alternatives may have significant impacts. Types of impacts can be divided into those caused by construction and those resulting from operation of the system.

Construction Impacts

Construction impacts are, in general, temporary and not of long-term significance. However, the actual facilities would represent permanent changes to sites.

Temporary Construction Impacts

Construction disturbs the land, resulting in potential soil erosion and increased sedimentation. Dewatering during excavation could cause temporary groundwater lowering. Construction equipment emits air pollutants, increases nearby noise levels, and may affect nearby visual quality. Sensitive land uses, such as parks and historic and cultural resources, may be particularly affected. Construction may disturb wildlife and reduce their populations. Construction may disrupt nearby businesses, resulting in loss of income. Construction may cause traffic congestion and may temporarily shut off utilities.

Construction may impede access to public facilities with traffic restrictions, parking or loading zone displacement, or other factors. Emergency vehicles may also be impeded along or across roadways involved in project construction. The magnitude of impacts depends on the geographic extent of the construction required for the alternatives under consideration.

All of the alternatives would have some unavoidable construction impacts, roughly proportional to the scale of construction, with the fewest impacts under the TSM Alternative and the greatest under the Rail/TSM Alternative. Both the Transitway/TSM and Rail/TSM Alternatives involve construction along rail rights-of-way, which could affect rail operations.

Construction impacts of the Rail/TSM Alternative would be several times greater than the TSM or Transitway/TSM Alternatives. Construction might have regional effects on traffic congestion and speeds. The most significant

localized construction impacts would occur during construction of underground stations along urban arterials. Direct impacts would include:

- o high levels of noise
- o production of dust and diesel exhaust
- o mud affecting roadways, sidewalks, and neighboring businesses
- o significant effects on traffic resulting from lane closures and detours.

Construction of underground stations in commercial areas would have significant traffic, noise, dust, mud, and air quality impacts on adjacent businesses. Construction would also result in a reduction in parking, require pedestrian detours, and increase delivery costs, reducing business income. Utility disruptions could result in temporary business closures. Some businesses might fail or relocate, particularly those whose income was dependent on successful competition with businesses in other parts of the region.

Tunneling for the Rail/TSM Alternative would temporarily lower local groundwater levels. Building new bridges over the Duwamish, Puyallup, and Sammamish Rivers, and probably Mercer Slough, could temporarily increase suspended sediments. In the Duwamish River, suspended sediments could be contaminated with heavy metal and hydrocarbons. The Rail/TSM Alternative could affect ecosystems in Mercer Slough, the Duwamish, Puyallup, Cedar, and Sammamish rivers, and Swamp, Hylebos and Kelsey creeks.

Commuter Rail Element

Temporary construction impacts would mainly occur in station areas and could affect adjacent properties and arterials as noted above.

Permanent Construction Impacts

Construction results in permanent land use changes, with permanent impacts on hydrology, habitats, visual quality, roadway capacity, utilities, parks, and historic and cultural resources. Construction could uncover hazardous waste, resulting in a need for remediation or alignment rerouting. In general, impacts would be proportional to the scale of construction.

No-Build Alternative

No-Build construction will result in local increases in impervious surface on sites, with slightly increased levels of runoff into storm drainage systems. It will remove small areas of vacant land, resulting in slight reductions of habitats. Construction will have minor impacts on local visual quality.

TSM Alternative

The TSM Alternative would require about 199 acres in business/industrial areas and 174 acres in residential areas. This would probably require some business, residential, and utility relocation. Park-and-ride lots could visually conflict with surrounding land uses. New ramps could affect views from some neighborhoods. Impervious surface could increase by as much as 374 acres, increasing runoff by 49 acre-feet during the 25-year storm. Construction on currently vacant land would locally reduce wildlife habitat.

Transitway/TSM Alternative

The Transitway/TSM Alternative would need about 293 acres of business/industrial land and 190 acres of residential land, probably requiring relocation of some businesses, residences, and utility lines. Stations, park-and-ride lots, and new ramps could conflict visually with surrounding neighborhoods. Impervious surface could increase by up to 482 acres, increasing runoff by 60 acre-feet during the 25-year storm. Construction on vacant land could locally reduce wildlife habitat.

This alternative would have severe and permanent impacts on traffic in the North Corridor by closing the I-5 express lanes to SOVs. Closure of part of 114th Avenue NE in Bellevue would have restrict access to adjacent businesses. The busway from Spokane Street to SR-599 would require railroad track relocation.

Rail/TSM Alternative

At-grade and aerial structures in roadways could permanently reduce road and intersection capacity on East Marginal Way, I-5, Martin Luther King, Jr., Way, and arterials in Tacoma, Federal Way, SeaTac, south Snohomish County, and Everett. The nonrecommended I-5 alignment between downtown Seattle and the University Seattle would have severe impacts on traffic congestion in Seattle's North End.

The Rail/TSM Alternative would require 1,021 acres, probably resulting in some relocation of businesses, residences, and utilities. The exclusive guideway could separate parks from nearby neighborhoods. The alternative may alter the visual quality of areas along alignments, near new ramps, and at station locations. Increased impervious surface could increase runoff by as much as 128 acre-feet during the 25-year storm. Construction on vacant land would locally reduce wildlife habitat.

Tunneling for the Rainier Valley, Capitol Hill, and Bellevue Way alignments could increase the probability of uncovering hazardous waste or contaminated groundwater, requiring remediation or moving the alignment.

Commuter Rail Element. Permanent impacts would mainly occur at station areas, with construction of stations and park-and-ride lots.

Operations Impacts

Operational impacts may occur because of the actual transit system operation or due to land use or other changes caused by the alternative.

Direct Operations Impacts

Bus-based transit systems typically emit air pollutants; pollutants may also be washed into surface waters. To the extent that the build alternatives increase the number of miles traveled by transit vehicles as compared to the No-Build Alternative, they will increase energy use and emission of pollutants. Air and water pollutants may in turn affect human health and ecosystems. However, these effects would be more than offset by decreases in vehicle miles traveled in the region as compared to the No-Build Alternative. Use of alternative fuels would further reduce transit emissions.

In the case of the No-Build, TSM, and Transitway/TSM Alternatives, electricity use would be limited to Metro's trolley and streetcar services. Electricity use would be about double the No-Build Alternative under the TSM and Transitway/TSM Alternatives. Electricity use would be much greater under the Rail/TSM Alternative. Even under the Rail/TSM Alternative, electricity use would be an insignificant fraction of regional electric demand.

Direct operational effects include increased transit-related noise. Quiet residential areas, parks, and sensitive public facilities adjacent to alignments, stations, transit centers, and park-and-rides would be particularly affected. Wildlife in natural areas could also be affected. Because the TSM and Transitway/TSM Alternatives tend to use facilities along existing rights-of-way, while the Rail/TSM Alternative is likely to use some alignments off existing roadways, this effect may be more noticeable under this alternative.

Transit service levels have direct impacts on transit riders. In the case of the No-Build Alternative, the demand for transit service will exceed system capacity, resulting in overcrowded buses and loss of some peak-hour riders. Under the TSM and Transitway/TSM Alternatives the number of buses required to meet demand in downtown Seattle would exceed street and tunnel capacity, resulting in loss of riders.

Commuter Rail Element

Commuter rail is not expected to have any significant adverse operational impacts. There may be some impacts on traffic flows at at-grade crossings due to increased train traffic.

Indirect Operations Impacts

Transportation-Related Impacts

The alternatives will affect the operations of the entire transportation system. The build alternatives would contribute to a reduction in traffic and an increase in mobility as compared to the No-Build Alternative. An increase in traffic means reduced travel times, increased emission of air pollutants, and increased pollutant loadings in stormwater runoff. The regional increase in vehicle miles under the No-Build Alternative is an unavoidable adverse impact of that alternative. Locally, to the extent that an alternative increases automobile traffic near a park-and-ride lot or station, it will have adverse impacts on air quality, noise, and traffic. The likelihood of such local impacts will increase with increased transit investment, with the greatest effects likely under the Rail/TSM Alternative.

Land Use-Related Impacts

The transportation system increases the attractiveness of certain areas for development, primarily by increasing accessibility. However, the transportation system may also reduce the attractiveness of some areas because of adverse traffic, noise, and air quality impacts. Development may constitute a beneficial or an adverse impact, depending on the community. Displacement of residential uses by commercial uses is often an adverse impact, but in certain areas may be beneficial. To the extent that the transportation system does not support the types of development envisioned in adopted land use plans, it can be said to have an adverse impact.

Vision 2020 serves as the region's adopted land use and transportation plan for the year 2020. The goals of Vision 2020 are least supported by the No-Build Alternative. The No-Build Alternative would discourage development in many activity centers by doing little to improve accessibility and would encourage development on the urban fringe, contrary to the plan's intent. The TSM and Transitway/TSM Alternatives would support some of the land use policies of the plan, but would be unable to provide efficient transit service in crowded activity centers. The Rail/TSM Alternative would be the most consistent with the Vision 2020 plan.

Commuter Rail Element

Commuter rail could have indirect impacts on traffic, noise, and air quality at station areas; otherwise, indirect impacts would be beneficial.

Areas of Controversy and Uncertainty and Issues to Be Resolved

The alternatives considered in the Final EIS will likely generate issues that will need to be addressed during the subsequent project-level planning phase. The principal issues to be resolved include:

Selection and Development of Alternatives

The most important decision involves which alternatives should be carried forward into more detailed, project-specific planning analysis and environmental review. At the broadest level, this choice is among the alternatives examined in the System Plan and the System Plan FEIS. However, several related issues, described below, need to be considered before choosing an alternative.

Scale of the Alternatives. In adopting a final System Plan, the JRPC could chose an alternative from among those evaluated in the FEIS or it could chose an alternative smaller in scale. For example, the draft System Plan recommends a variation of the Rail/TSM Alternative considered in the DEIS. That variation focuses on a shorter planning horizon (2015 versus 2020), fewer miles of rapid rail (84 miles versus 124 miles), and other differences in scale. Other proposals emerged during the public comment process, such as the SMART (Sound Metropolitan Regional Transit) proposal, which promotes constructing a short "starter" system before implementing a full regional rail system.

The FEIS provides the JRPC with all the information and analytic tools it needs for evaluating the environmental impacts of such alternatives. In general, the environmental impacts of such scaled-back alternatives would be lower than the impacts of the alternatives discussed in the FEIS. So long as the impacts of the selected alternative fall within the range of impacts and alternatives analyzed in the FEIS, no additional environmental review would be required before the JRPC makes a decision on the System Plan. Section 2.2.4 provides a more detailed example of how the FEIS can be applied to analyzing a smaller-scale Rail/TSM Alternative.

Technology Options. Choosing among the alternatives involves a choice between bus or rail technology for regional service. A combined

rail/transitway system could also be picked. Similarly, the commuter rail element of the Rail/TSM Alternative could be considered independently of the rest of the rail system and could conceivably be combined with elements of the other build alternatives. The FEIS provides decision makers with the analytic tools for assessing the environmental impact of such an alternative. The basic technology choice will be based on a number of evaluation criteria, including the cost-effectiveness of each alternative, both overall and in the North, South, and East corridors. This decision will be made by the JRPC during system-level planning.

While the EIS assumes that conventional rapid rail would be used for the Rail/TSM Alternative, a final choice on rail technology(ies) has not been made. System needs have been defined as a minimum set of operating characteristics that any rail technology would have to meet to be effective in this region. If the Rail/TSM Alternative is chosen for further evaluation, a final decision will have to be made on the specific type of rail technology. The choice will be between basic rail technologies, such as conventional light rail versus a higher performance rail system. Factors which will be considered in the rail technology choice will include system capacity, speed, passenger loading characteristics, traction power systems, and control systems. This decision will be made during project-level planning.

Exclusive versus Nonexclusive Rights-of-Way. In defining the alternatives, it has been assumed that the Rail/TSM Alternative rail system will run on mostly exclusive rights-of-way with no at-grade crossings (except for commuter rail and possibly the connection between Bellevue and Renton and the ends of the line in Tacoma and Snohomish County). Transitway/TSM Alternative bus service would run on a combination of exclusive and nonexclusive rights-of-way. Bus service in the TSM Alternative would operate on nonexclusive rights-of-way. Exclusive rights-of-way, while generally costing more than nonexclusive rights-of-way, offer higher speeds and greater reliability because of fewer conflicts with general-purpose traffic. Systems with nonexclusive rights-of-way run at slower speeds, but generally are less expensive. The alternative choice thus involves choosing the amount of exclusive rights-of-way that will be appropriate for the regional public transit system. These decisions will be made during both system-level and project-level planning.

Generalized Rail Alignment Options. If the Rail/TSM Alternative is chosen for more study, generalized alignment choices must be made. In the North Corridor, alignment choices must be made, particularly in north King County and Snohomish County. In the South Corridor, alignment choices must be made between SR-99 and I-5 through Federal Way. In the East Corridor, alignment choices must be made between downtown Bellevue and Redmond and between Mercer Island and Bellevue. Other alignment variations may be proposed and considered in the future. These decisions will be made during system- and project-level planning.

Specific Alignment Options. Once general alignments are picked, specific routes and profiles (aerial, at-grade, or underground) must be developed and chosen as a part of project-level design and environmental review. Specific alignment choices will be made based on cost, feasibility, environmental impacts, and extensive coordination with local communities and the public. These decisions will be made during project-level planning.

Station Area Planning. Final station or transit center locations will involve a number of considerations, including cost, land availability, environmental

impacts, accessibility to alignments, and public and local jurisdiction input. A decision must be made in each station area whether to encourage intensified development or to enact policies that preserve current land uses at that location. Such decisions will in part depend on decisions made in the current growth management planning process. Because the final decisions will be made by affected jurisdictions, the RTP will work with them to ensure that station facility planning incorporates significant local input and station area planning is directed by local agencies.

TSM Improvements. Although TSM improvements have been assumed for each build alternative, actual TSM improvement implementation will require more study and refinement based on public comment and input from local jurisdictions. For example, the City of Seattle has proposed a service structure for that city that would be a major departure from previous assumptions. Some TSM capital improvements and service structures may be deleted or modified while others may be added, based on the project-level review process. Similarly, the specific TSM service structures assumed under the three build alternatives may be modified, based on the ridership modeling results and local community and agency input. These decisions will be made during project-level planning.

Support Facility Locations. All three build alternatives will require more support and maintenance facilities in the three-county region. While the System Plan FEIS identifies general needs and possible general locations for such facilities, specific alternative locations for such facilities must be chosen as part of project-level planning and environmental review processes, at least for the initial project phase.

Phasing. The System Plan FEIS only covers the issue of phasing in a generic way. If the Rail/TSM Alternative is chosen, decisions will have to be made as to the minimum operating segment length in each corridor and the extent of the initial rail system. In addition, supplemental alignments and extensions may be considered in certain areas. Because of its smaller extent and capital costs, transitway system phasing will be less of an issue. However, TSM improvement phasing and its relationship to rail or transitway facilities will be an important issue, since TSM improvements may, on the one hand, supplement or mitigate the construction impacts of rapid transit facilities and, on the other hand, may be redundant to components of the rapid transit system. These decisions will be made during project-level planning.

Financing. Funding sources may include a sales tax increase, a motor vehicle excise tax increase, federal funding, and private funding. Some federal funds have also been authorized by the Surface Transportation Act of 1991. In addition, consideration has been given to gasoline and other taxes. The financing option mix will be presented to the voters for approval. These decisions will be made by the JRPC during system-level planning.

System Development

The System Plan FEIS presents the fully developed regional transit system in the year 2020. System development will occur gradually. Each new capital improvement or service increment will affect ridership in a way that may or may not have been accurately predicted. Because the System Plan will be implemented in stages, the results of each phase may change subsequent plan phases. Modifications could include service increases or decreases to particular areas, phasing changes, and TSM or rapid transit capital improvement changes. These decisions will be made during project-level planning.

Land Use. Changes in land use and development over the next thirty years will affect how the regional transit system develops. System Plan ridership forecasts are based on an assumption (as mandated by the Federal Transit Administration (Ryan 1986)) that development patterns or land use will not substantially change over the life of the project. In reality, substantial capital investments in public transit, particularly systems with exclusive rights-of-way, often significantly affect residential and employment densities near transit lines. Increased densities along transit lines would increase public transit demand, requiring additional transit capacity modifications to meet increased demand. Demand could also be consciously increased by jurisdictional requirements, such as zoning, in some station areas. On the other hand, the achievement of higher density and concentrated land uses could be curtailed or prevented by failure to upgrade the capacity of other public infrastructure, such as sewer and treatment plant capacities. The System Plan FEIS does address potential changes in public transit demand and how these would affect the capacity requirements of the alternatives.

Capacity Constraints in the Transit Network and Transportation System

Ridership and traffic modeling for the System Plan alternatives indicates that:

- o Ridership demand would exceed transit capacity at many critical locations in the No-Build Alternative
- o Bus volumes to meet ridership needs would exceed street capacity in downtown Seattle, the University District, and a few other key locations under the TSM and Transitway/TSM Alternative, but not under the Rail/TSM Alternative
- o Automobile volumes will exceed roadway capacity in certain areas under all alternatives.

The forecasting models predict ridership and traffic levels in a functioning transportation system. It is more difficult to predict what will happen if the transportation system does not function. In the short term, it is easy to predict that overcrowded buses and traffic jams will result if demand exceeds system capacity and that has been incorporated into the environmental analysis. In the long term, it is likely individual behavior and public policy will change in response to transportation system failures. Such changes are difficult to predict and are beyond the scope of this environmental impact statement.

Environmental Issues

Site-Specific Environmental Impacts. As noted, the System Plan FEIS is a programmatic document. It does not consider detailed impacts of the alternatives on particular sites or locations, unless it is clear that impacts are probable at a specific site. If one of the build alternatives is chosen, project-level environmental review will identify significant environmental impacts of that alternative at specific locations. Section 1.6.3 gives examples of impacts that will be more appropriately considered in project-level review.

Regional Electrical Power Sources. Although the System Plan FEIS considers electric power sources for the Rail/TSM Alternative and regional power providers' ability to meet power requirements, it is impossible to forecast specific electric power sources used to supply the system in the future. The regional power sources in the year 2020 represent a decision that will have to

be made through the political process. The Bonneville Power Administration expects to produce most of the region's additional energy needs through conservation, greater power generation and transmission efficiency, cogeneration in industrial plants, and natural gas-fired combustion plants. Except for natural gas, these sources would probably not have significant potential adverse environmental impacts. Because the electric power requirement of any build alternative is a very small percentage of the total regional supply (Moorman 1992), it was not considered necessary to evaluate further the effects of policy alternatives. The selected System Plan alternative is not likely to affect the regional power supply choice in the future.

Transit Fleet Fuel Requirements. Although it is clear that the transit fleet in the year 2020 will be required by the federal Clean Air Act to produce far fewer air pollutant emissions than today's transit fleet, it is not clear what fuel type will be used to meet emissions requirements. There could be changes in air pollutant emission levels and the demand for particular fuels, depending on the fuel that is ultimately chosen.

Health Effects of Electromagnetic Fields. The potential health effects of low-level electromagnetic fields have been a recent subject of public concern. Because the Rail/TSM Alternative would require extensive electrical distribution facilities, the potential EMF radiation effects from the distribution system are considered in this EIS. Research to date suggests that the potential health risks of exposure to the direct current distribution lines likely to be used for the rail system are significantly less than the risks associated with the more common alternating current distribution lines. Epidemiologic studies of EMF effects have not produced conclusive evidence of any health hazards at the field levels generally associated with rail power distribution systems. Applicable EMF research will continue to be monitored and reported during the project-level environmental review process.

Impact Area	No-Build		TSM		Transitway/TSM		Rail/TSM	
	Construction	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Earth	• No Significant Impacts	• No Significant Impacts	• No Significant Impacts • More Earth Movement than No-Build	• No Significant Impacts	• Minor Tunneling: Otherwise Impacts Similar to TSM	• No Significant Impacts	• Tunneling Alignments May Result in Settlement, Erosion and Ground Water Impacts	• Seismic Issues Related to Tunnels Will be Considered During System Design
Air Quality	• Minimal Impacts	• Regional Air Quality Standards May Not Be Met; Est. • 2020 Base Level Motor Vehicle Emissions in M.Tons/Day: CO 962, HC 212, NOx 139	• Construction CO and Dust • Congestion-Related CO	• Modest Air Quality Benefit (New Transit Riders) • Emission Reductions from No-Build in M.Tons/Day: CO-16, HC-2, NOx-2	• Construction CO and Dust • Congestion-Related CO	• Modest Air Quality Benefit • Emission Reductions from No-Build in M.Tons/Day: CO-18, HC-4, NOx-3	• Construction CO and Dust • Congestion-Related CO; Commuter Rail Relief in South Corridor.	• Consistent with Vision 2020 Plan • Emission Reductions from No-Build in M.Tons/Day (including commuter rail): CO-40, HC-9, NOx-3
Noise/Vibration	• Impacts of Adopted/ Funded Projects Only	• Increased Traffic Noise on Principal Roadways During Non-Peak Periods • Increased Traffic Noise on Minor Arterials and Local Streets	• Localized Construction Noise Impacts Related to New HOV Lanes and Park-and-Ride Lots	• Localized Increases of Traffic Noise Near New Access Ramps, and Park-and-Ride Lots	• Nightime Construction Noise Impacts (e.g. Convention Place Station to I-5 Express Lane Tunnel, Transitway Between SE 8th St. and SR 520) • Greater Amount of Construction Activity and Associated Noise Impacts than TSM Alternative	• Increased Bus Operations Within Transitways Would Contribute to Some Increase in Traffic Noise Over TSM Alternative	• Nightime Construction Noise/Vibration Impacts of Tunnel/Subsurface Stations and Bridge Construction • Greater Amount of Construction Associated Noise than Transitway Alternative • Bridge Alignment Over Portage Bay Would Have Greater Noise Impacts Than Tunnel Alignment • Bellevue Way Alignment Would Have Greater Impact Than I-405/BNRR Alignments	• Sensitive Area: I-5 Corridor from Ship Canal Bridge to Snohomish County • Noise from Surface or Aerial Rail Structures Could be Greater Than Bus Alternatives
Water Quality/ Hydrology	• No Significant Impacts	• No Significant Change in Stormwater Runoff Quantities	• Temporary Increases in Erosion and Sediment in Surface Runoff • Potential Dewatering at Multi-Level Parking Sites	• Approximate Increase of 48-Acre-Feet of Surface Runoff During 25-Year Storm • Potential for Localized Impacts (e.g. Landscaped Areas)	• Temporary Increases in Erosion and Sediment in Runoff • Potential Dewatering for Minor Tunnel Construction • Potential for Impacts Increased Over TSM Alternative Due to More Construction	• Approximate Increase of 65-Acre-Feet of Surface Runoff During 25-Year Storm • Potential for Localized Impacts	• Temporary Increases in Erosion and Sediment in Runoff • Potential Tunnel Dewatering (e.g. Capitol Hill, Rainier Valley and Downtown Bellevue Alignments) • Bridge Constructon over Duwamish, Puyallup, Cedar and Sammamish Rivers, Mercer Slough, Swamp Creek, and Possibly Portage Bay • Temporary Increase in Suspended Solids	• Approximate Increase of 141-Acre-Feet of Surface Runoff during 25-Year Storm • Potential for Localized Impacts (e.g. Small Drainages, Landscaped Areas)

Regional Transit Project

KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

RTPDD6

Environmental Summary Matrix

System Plan EIS

FIGURE 4

Impact Area	No-Build Construction	No-Build Operation	TSM Construction	TSM Operation	Transitway/TSM Construction	Transitway/TSM Operation	Rail/TSM Construction	Rail/TSM Operation
Ecosystems	• Temporary Habitat Disturbance and Loss Associated with Park-and-Ride Lots	• Localized Impact Near Park-and-Ride Sites • Potential Loss of Habitat Associated with Urban Sprawl	• Temporary Habitat Disturbance and Loss Associated with Park-and-Ride Lots, Access Points and HOV Lanes	• Localized Impact Near Park-and-Ride Sites	• See TSM • Potential Wetland Impact on BNRR Tracks North of Bellevue	• See TSM	• Major Ecosystems Potentially Affected: Swamp Creek, Duwamish, Puyallup, Sammamish and Cedar Rivers; Kelsey Creek, Mercer Slough	• See TSM • Access/Safety Impacts in Undeveloped Areas
Energy	• 2.5 Trillion BTUs Construction Energy Consumption.	• Transit Fleet Consumption: 1.9 Trillion BTUs per Year and Vehicle Consumption of 190.7 Trillion BTUs per Year	• Energy Costs Associated with Site Preparation, Construction of HOV Lanes/Transit Facilities, and Transferring Materials to Subject Sites(s): 31.7 Trillion BTUs	• Transit Fleet Consumption: 3.4 Trillion BTUs per Year and Vehicle Consumption of 187.5 Trillion BTUs • 17.2 Year Payback Period	• See TSM: 39.5 Trillion BTUs Construction Energy Cost	• Transit Fleet Consumption: 3.5 Trillion BTUs per Year and Vehicle Consumption of 187.2 Trillion BTUs • 20.6 Year Payback Period	• See TSM • Energy Expended to Construct Guideway and Fabricate Vehicles • 51.8 Trillion BTUs Construction Energy Cost	• Transit Fleet Consumption: 3.8 Trillion BTUs per Year and Vehicle Consumption of 183.7 Trillion BTUs • 9.5 Year Payback Period
Visual Quality/ Aesthetic Resources	• Minimal Park-and-Ride Construction Impacts	• Increased Traffic Congestion Affecting Corridor Aesthetics	• Localized Impact from Equipment/Construction Activity, Temporary Loss of Vegetation	• Park-and-Ride Site Impacts (e.g. Increased Illumination, Change in Land Use)	• See TSM	• Transitway Stations Could Improve Visual Quality and Character of Activity Centers	• See TSM Alternative	• Potential Adverse Impacts to Residential Areas with Aerial or Surface Rail • Potential Enhancement of Aesthetic Character of Activity Centers
Transportation VMT: Vehicle Miles of Travel VHT: Vehicle Hours of Travel	• Minor Traffic Impacts	• Annual Transit Ridership: 109 Million • VMT: 84.2 Million/ Day • VHT: 5.1 Million/Day • Transit Demand Exceeds Capacity in Downtown Seattle and University District	• Temporary Traffic and Congestion Impacts During HOV, Park-and-Ride and Transit Base Construction	• Annual Transit Ridership: 134 Million • VMT: 82.7 Million/ Day • VHT: 5.0 Million/Day • Transit Demand Exceeds Capacity in Downtown Seattle	• Temporary Impacts to Rail Facilities (Spokane Street to SR 599 and From Downtown Bellevue to SR 520) • Potential for Regional Congestion Impacts • Permanent Closure of I-5 Express Lane to SOVs • Permanent Closure of 114th Avenue NE in Bellevue CBD	• Permanent Closure of I-5 Express Lane to SOVs • Fatal Flaw: Major Congestion on I-5 N. of Downtown Seattle • Permanent Closure of 114th Avenue NE • Annual Transit Ridership: 135 Million • VMT: 82.6 Million/ Day • VHT: 5.0 Million/ Day	• See TSM • Potential for Regional Traffic Congestion Impacts • Closure of Streets for Tunnel Construction • Reduced Freeway/ Arterial Street Capacity on At Grade Alignments • Commuter Rail Service: Temporary Disruption of Freight and Passenger Rail Operations Between Seattle and Tacoma • Bridge Construction: Temporary Navigational Impacts	• Traffic Capacity Reduction on I-5 Between Seattle CBD and Northgate (I-5 Alignment) and on SR 99 South of SeaTac (If This Alignment is Chosen) • Potential Fatal Flaw (N. Corridor I-5 Alignment Only): Major Congestion on I-5 N. of Downtown Seattle • Annual Transit Ridership: 157 Million • VMT: 81.0 Million/ Day • VHT: 4.9 Million/Day

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RTPDD6

Environmental Summary Matrix

System Plan EIS

FIGURE 4

Impact Area	No-Build		TSM		Transitway/TSM		Rail/TSM	
	Construction	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Land Use/ Economics	• Park-and-Ride Specific Land Use Changes	• Increased Pressure for Development of Urban Fringe • Inconsistent with Local and Regional Plans • Operations and Maintenance Expenditures Will Generate Regional Output of $448 Million	• Acquisition of 374 Acres of Land • Temporary Disruption Adjacent Businesses/ Residences • Generate Approximately 500 Construction Jobs (25 years), 400 Jobs in Related Industry and $2.6 Billion in Production in Puget Sound Region	• Increased Development Opportunities Around Transit Centers	• Acquisition of 482 Acres of Land • Temporary Disruption Adjacent Businesses/ Residences • Generate Approximately 600 Construction Jobs (25 years), 400 Jobs in Related Industry and $3.0 Billion in Production in Puget Sound Region	• See TSM Alternative • Potential for Increased Employment and Population Near Major Centers (e.g. Northgate, South Snohomish County, Duwamish Industrial Area, Kent-Des Moines Road, South 272nd Street, South 84th Street) • Partially Consistent With Vision 2020 Plan	• Acquisition of 1021 Acres of Land • Temporary Disruption of Adjacent Businesses/ Residences • Generate Approximately 1,300 Construction Jobs (25 years), 1,700 Jobs in Related Industry and $6.2 Billion in Production in Puget Sound Region • Significant Local Impacts During Construction of Subway Stations	• Consistent with Vision 2020 Plan • Increased Accessibility of Station Areas • Provide for Employment/ Development Growth in Centers • Potential for Intensification of Land Use at Station Areas • Potential Adverse Impacts to Residential Neighborhoods Surrounding Park-and-Ride Stations
Utilities and Public Services	• No Significant Impacts • Minimal Impacts to Utility Service and Systems	• Potential Congestion May Result in Impeded Access to Particular Areas by Mobile Services Such as Police, Fire Protection or Emergency Medical Services • Minimal Impacts to Utility Services and Systems	• Potential Short-Term Impacts on Access to and Usability of Public Service Facilities and on the Movement of Emergency Vehicles in the Vicinity of Construction Activity • Minimal Impacts to Utility Services and Systems	• Impacts Limited to Public Service Facilities Close to Park-and-Ride Sites or Other TSM Facilities • Minimal Impact to Utility Services and Systems	• Potential Short-Term Impacts on Access to and Usability of Public Service Facilities and on the Movement of Emergency Vehicles in the Vicinity of Construction Activity • Potential Impact of Relocating Service Facilities	• Potential Reduction in Accessibility and Public Services From Some Locations or Impeded Access for Mobile Emergency Services • Potential Air Quality and Noise Impacts on Public Service Facilities • Emergency Access to Elevated or Tunnel Segments of Alignments will Require Special Planning and Equipment	• Potential Short-Term Impacts on Access to and Usability of Public Service Facilities and on the Movement of Emergency Vehicles in the Vicinity of Construction Activity • Potential Impact of Relocating Service Facilities • Potential Impacts on Utility Services and Systems Due to Tunneling Activities	• Potential Reduction in Accessibility and Public Services From Some Locations or Impeded Access for Mobile Emergency Services • Potential Air Quality and Noise Impacts on Public Service Facilities • Emergency Access to Elevated or Tunnel Segments of Alignments will Require Special Planning and Equipment
Parks and Recreation	• No Significant Impacts	• No Impact	• Potential Short-Term Impact to Approximately 21 Parks (e.g. Access, Usability, Right-of-Way)	• Impacts Limited to Park Lands Close to Park-and-Ride Sites • Improved Accessibility to Parklands	• See TSM Alternative	• See TSM Alternative	• Potential Impact to 50 Parks (e.g. Access, Visual, Right-of-Way, Usability)	• See TSM Alternative • Improved Accessibility to Parklands
Historic and Cultural Resources	• No Significant Impacts	• No Significant Impacts	• Potential Impacts to Historic Districts/ Properties, Including Keeler's Corner in Lynnwood	• See Construction Impacts	• Potential Impacts to Rainier Cold Storage and Ice/Seattle Brewing and Malting Company Building Airport Way South and Georgetown City Hall. Ramps and Stations Could Impact Nearby Historic Properties	• See Construction Impacts	• Greatest Potential for Impacts to Historic Resources, Including Capitol Hill Area, Harvard-Belmont Historic District, Volunteer Park, University District, Columbia City Historic District, Historic/ Conservation Districts in Tacoma and Properties in Everett	• See Construction Impacts • Operations of Commuter Rail Could Affect Historic Properties in Downtown Seattle, Green River Valley, Kent, Auburn, Puyallup and Puyallup River Valley

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Environmental Summary Matrix

System Plan EIS

FIGURE 4

1.0 Introduction

1.1 Background

The Regional Transit System Plan addresses transportation and mobility issues in the central Puget Sound region, encompassing King, Pierce, and Snohomish counties. Population and employment have grown rapidly in this area during the last decade and that growth is expected to continue over the next 30 years. Consequently, the three counties, each of which originally grew around its own urban center, have become a single urban growth area with major employment centers developing in suburban areas. Transportation planning has necessarily become regional in scope. Population and employment decentralization, increasing population, and increasing vehicle use by households have strained the limits of the transportation infrastructure. They have also exacerbated air quality problems.

The region has three options to deal with the problem: (1) significantly expand freeway and arterial networks to accommodate expected automobile traffic increases, (2) find ways to significantly increase transit, high-occupancy vehicle, bicycle, and pedestrian trips to slow the increase in automobile traffic, and/or (3) reduce growth in total vehicular trips and trip lengths by changing land use patterns. Because of the environmental and policy constraints on expanding single-occupant vehicle facilities, the region's jurisdictions have turned to the second and third options. The Puget Sound Council of Government's (PSCOG's) Vision 2020 Plan (PSCOG 1990) emphasized public transportation improvements. Elected officials and transit providers, including Community Transit, Everett Transit, the Municipality of Metropolitan Seattle (Metro), Pierce Transit, and the Snohomish County Transportation Authority (SNO-TRAN) have been working together to develop a regional mass transit system that could provide a competitive alternative to single-occupant vehicles. These operators have also been working with local planning authorities and the Washington State Department of Transportation (WSDOT) to ensure compatibility of transit improvements with land-use and transportation plans. Metro, as the transit provider for the central and largest county in the three-county area, has taken the lead role in defining the alternatives by which a regional mass transit system could be realized by the year 2020. Those alternatives are the subject of this System Plan Final Environmental Impact Statement (FEIS).

The Joint Regional Policy Committee (JRPC) is guiding the Regional Transit Project. The JRPC, established according to state law in 1990, is made up of transit agency governing board members (local elected officials) plus the state's Secretary of Transportation. The transit agencies are Metro, SNO-TRAN, Community Transit, Everett Transit and Pierce Transit. The JRPC must approve the final Regional Transit System Plan before a multi-county Regional Transit Authority (RTA) is created and seeks voter approval for the plan.

An independent Expert Review Panel (ERP), also established according to state law, was appointed by the governor, legislature and state transportation department to make sure the analysis in the RTP proposal is sound. The ten-member panel approves methodology for all RTP analyses, reviews all RTP technical documents, and must complete its review of the analysis used to

develop the System Plan before the RTA presents a rapid-transit funding proposal to voters.

1.2 System Plan Definition

The JRPC recommended a draft System Plan to help focus public review and comment on alternatives described in detail in this DEIS. The draft System Plan addresses regional public transportation needs and objectives in Snohomish, King and Pierce counties. The following discussion summarizes the proposed system improvements, the Study Area, and its boundaries and corridors.

A recommended draft System Plan was issued at the same time as the DEIS. Copies of the System Plan are available from Metro. An address, telephone number, and contact person are provided in the Fact Sheet at the beginning of this document.

1.2.1 Description

The draft System Plan proposes capital improvements and service changes that will improve regional mass transit, increase transit speeds, service, and reliability, and encourage transit and high occupancy vehicle use by giving them priority on arterials and freeways. A rapid transit system is a central plan element. The plan identifies centers served, corridors, technology options, costs, and transportation system effects. The rapid transit system would be built over the next 30 years, with service projected to begin in the year 2001. This system is crucial to maintaining mobility to support regional growth strategies as outlined in PSCOG's *Vision 2020* plan. The capital improvements analyzed in the System Plan FEIS include a proposal for a rapid rail system serving Seattle, Tacoma, Everett, Bellevue and other centers, coupled with commuter rail in the Green River Valley. Alternatively, a lower-cost transitway system serving the same centers is analyzed in this FEIS, as well as a set of specific transportation system management (TSM) improvements, which are analyzed both as a separate alternative and as a stand-alone base for either rapid-transit alternative.

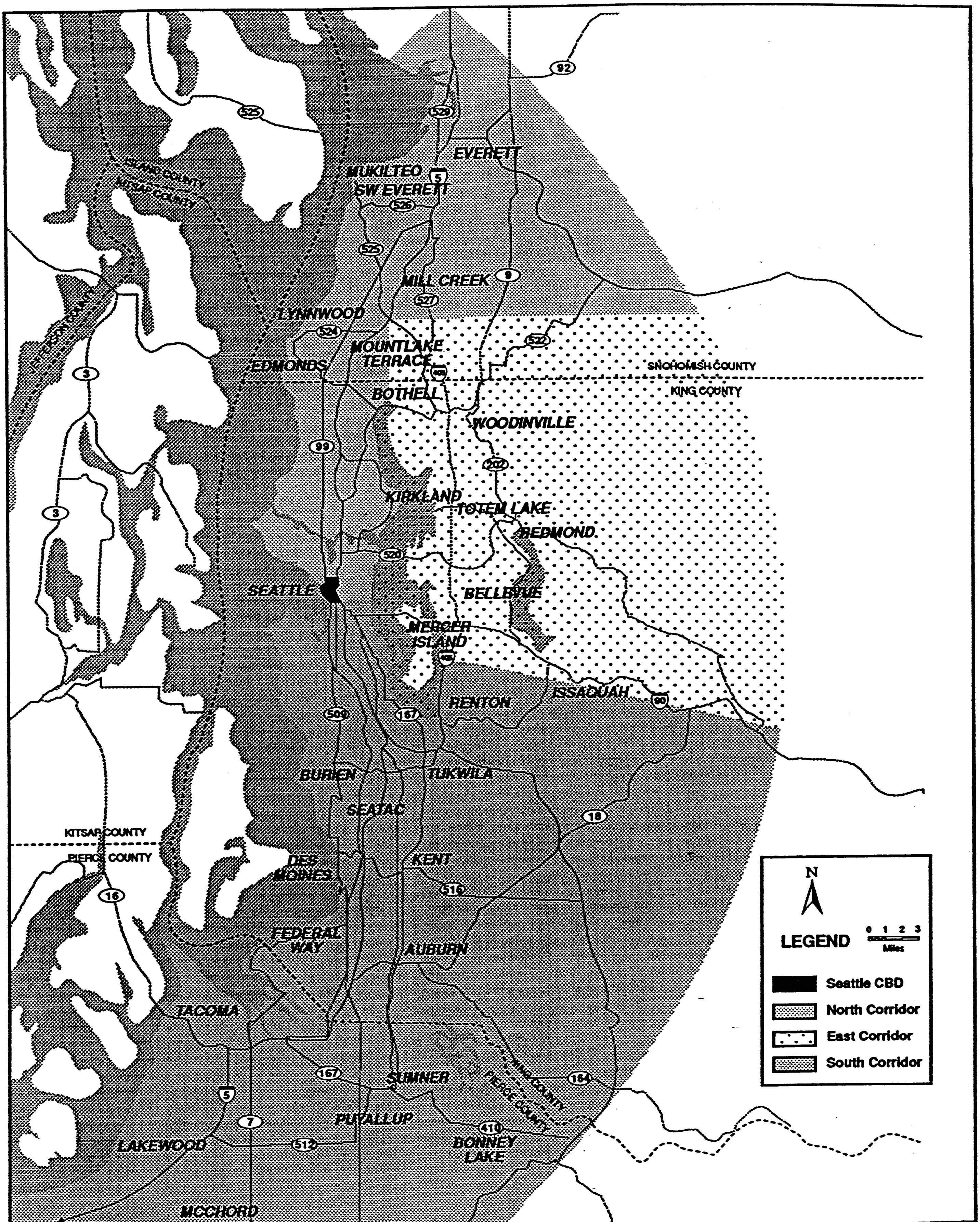
1.2.2 Boundaries

The System Plan is regional in scope, covering the urbanized areas of King, Pierce, and Snohomish counties. The plan study area includes the I-5 and I-405 corridors north to Marysville; the I-5, Green/Puyallup River valleys, and I-405 corridors south to Tacoma and Lakewood; and the I-90 and SR-520 corridors east to Issaquah and Redmond.

1.2.3 Study Area

The regional transit plan divides the study area into three major subareas (Figure 1.1), the North, South and East subareas. Downtown Seattle is included in all three subareas.

For simplicity, the three study subareas are referred to as the North Corridor, South Corridor, and East Corridor in this document. The corridors have been defined for study purposes only. The identified boundaries are not meant to reflect a staging plan for the System.



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Study Area Boundaries

System Plan EIS

FIGURE 1.1

hour speeds on freeways and major arterials are 50 percent slower. Travel speeds have also become very sensitive to minor traffic incidents. Due to congestion, a temporary loss of just one lane can slow traffic for an extended time.

- *A lack of alternatives* to the single-occupant vehicle (SOV), or personal automobile, underlies and aggravates the more apparent problems of congestion and slower travel. Existing alternative travel routes are limited by the region's topography. Most traffic is channeled into a handful of heavily-traveled corridors. Alternatives to single-occupant vehicle (SOV) travel are unattractive to many travelers.

The existing high-occupancy-vehicle (HOV) system provides limited benefit because it is fragmented. In key sections, the "system" currently allows travel in only one direction. Because buses operate in the same roadways as general and HOV traffic, transit typically offers no comparative speed advantage. Transit routes also cannot consistently provide convenient, timely connections to outlying destinations due to current funding limitations. These factors make it very difficult for transit to compete with SOVs.

1.3.2 Roots of Current Transportation Problems

Major transportation system changes are typically designed to meet travel needs 20 years in the future. Today's transportation problems can be traced to transportation investment decisions and travel changes that have occurred since about 1970.

Today's problems evolved from a lack of investment in major transportation infrastructure and facilities while the amount of miles traveled soared:

- Major transportation improvements recommended in past regional plans have consistently been deferred or eliminated. Today's transportation problems were clearly anticipated in previous regional plans. The improvements recommended to address these problems, however, have largely been eliminated or deferred. Though many reasons exist for not making investments, the net effect is that transportation system capacity has changed only marginally since 1970.

- Travel growth has far exceeded the projections on which past transportation plans were based. Today's travel volume is 30 percent to 70 percent greater than projected in past transportation plans. Because the improvements recommended in the past were based on lower travel volumes than exist today, there is a tremendous shortfall in transportation system capacity.

- Alternative investments for managing travel demand have not been able to solve the problem. In the late 1970s and early 1980s, attention was turned to public transit, vanpools, ridesharing, and other techniques to meet travel needs instead of building new roads. These efforts produced significant benefits, but they did not substitute for major improvements. Further, their potential benefit has been limited by development patterns and economics that have discouraged transit use and by the lack of infrastructure improvements.

- Continued residential suburbanization, a more rapid suburbanization of employment locations, and a continued trend toward lower-density development have increased the distance between home, work, and shopping areas. These trends have added to travel demand growth, since maintaining mobility now requires longer trips. This trend has been encouraged by free parking in most areas and low gasoline prices. The trends have also eroded alternative transit investments' effectiveness, since these work best when serving concentrations of employment, concentrations of population, or both.

1.3.2.1 Rejection of Previous Recommendations

In the past 25 years, several comprehensive transportation plans have been prepared recommending transportation investments for the central Puget Sound region. Each plan anticipated the major transportation problems faced today - severe congestion, declining travel speed, and a lack of transportation alternatives. With the notable exceptions of the downtown Seattle Transit Tunnel, the I-90 bridges, and the first phase of the HOV system, the improvements necessary to avoid these problems have not been made.

The following deferred or eliminated transportation investments could have altered the nature and reduced the scale of current problems:

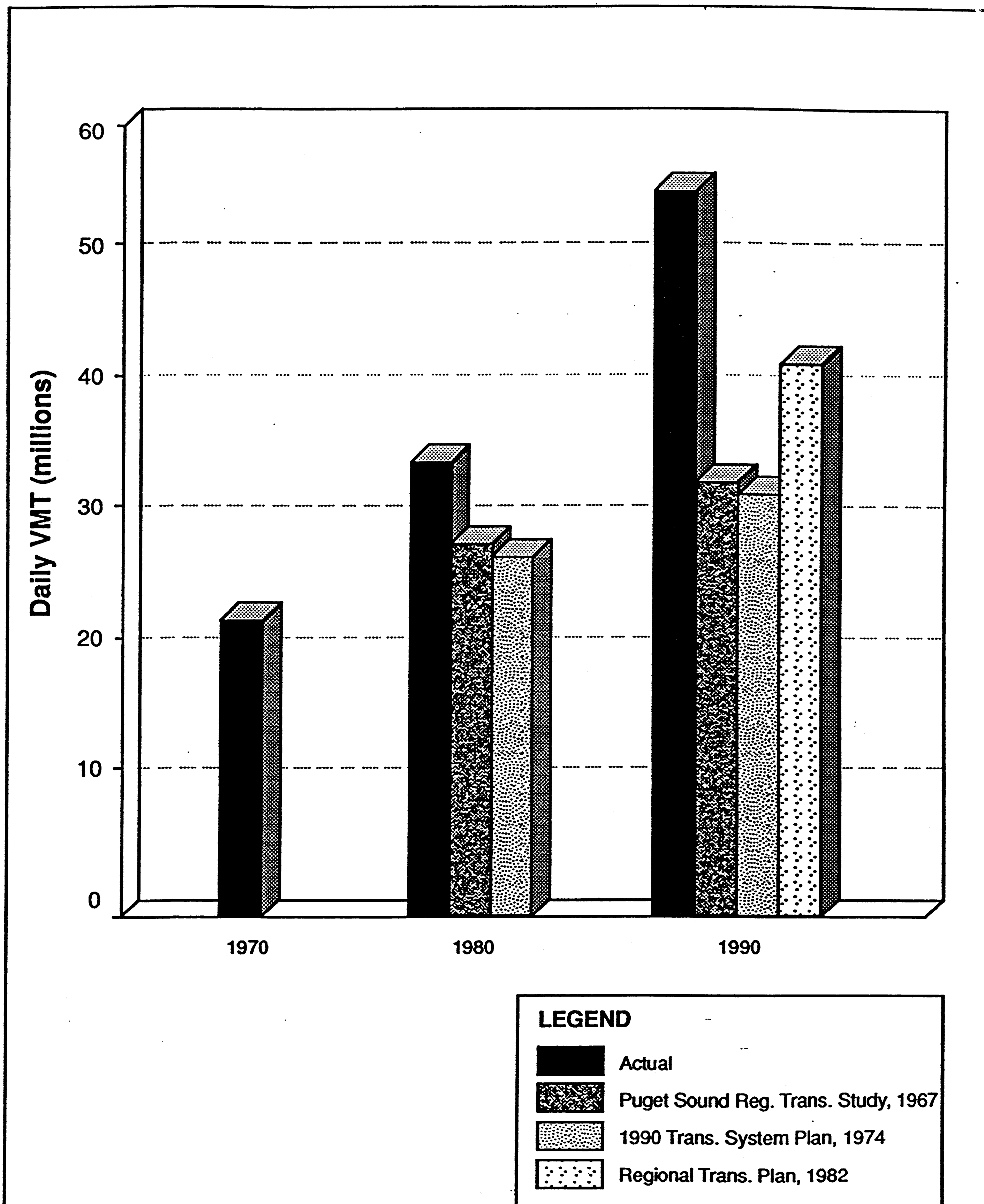
- 156 miles of freeways recommended in the Puget Sound Regional Transportation Study: Recommendations to 1990 (1967)
- a 47-mile rail rapid transit system recommended in Report on a Comprehensive Public Transportation Plan for the Seattle Metropolitan Area (1967)
- 87 miles of freeways and expressways and 89 miles of exclusive transitways recommended in the 1990 Transportation System Plan for the Central Puget Sound Region (1974)
- 118 miles of high-occupancy-vehicle (HOV) lanes recommended in the Regional Transportation Plan (PSCOG 1982).

These investments were not made because of the unattractive political and economic costs associated with building major roadways and a belief that low-cost alternatives to automobile travel could satisfy growing travel needs. The void left by eliminating or deferring the above projects proved difficult to overcome with low-cost alternatives.

1.3.2.2 Travel Demand Growth

Today's regional travel far exceeds projections used to support past transportation plan recommendations (Figure 1.2). Because those plans underestimated today's travel volumes, the problems resulting from eliminating and deferring major transportation investments have been compounded.

While travel can be measured in many ways, *vehicle miles traveled* (VMT) is a generally-accepted term for the overall travel volume on a transportation system. In 1990, PSCOG estimated daily VMT was about 55.1 million miles (PSCOG 1990). This compares to 32 million VMT forecasted for 1990 in



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Actual Versus Projected Vehicle Miles Traveled

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FIGURE 1.2

1967. Today's VMT already exceeds a year 2000 projection prepared just nine years ago.

Why has travel increased so dramatically? Several trends have contributed to its growth (PSCOG 1990):

- *Population and employment growth* dramatically *increased the number of trips*. Between 1970 and 1990, population in the region grew by 30 percent and employment doubled. Also, due to a prevalence of two-income families, trips were concentrated in peak periods.

- *Land-development patterns increased distance traveled*. In 1990, the average work trip was 9.8 miles, versus 8.7 miles in 1970. Average residential density declined from about 20 people per acre in 1970 to about 14 people per acre in 1990. This was a principal cause of longer trips.

- *Automobile ownership* increased by 108 percent between 1970 and 1990, adding to a *drop in automobile occupancy* (the number of people riding together). In 1990, there was roughly one car in the region for every person of driving age.

Today, we travel more, over longer distances, and with fewer people than in the past. This has overburdened the transportation system. Between 1990 and 2020, the central Puget Sound region is projected to grow by 52 percent in population and 57 percent in terms of jobs. Traffic is projected to increase by 78 percent. The projected results are sobering: peak period congestion of up to five hours each afternoon and average freeway speeds of less than 15 mph (PSCOG 1988).

1.3.2.3 Insufficiency of Low-Cost Transportation Investments

Several types of investment have been made since 1970 as an alternative to building roadways and major facilities. Transit service, vanpools, and ride-sharing have been used to stretch roadway capacity by reducing the vehicle numbers required to carry a given number of people. Other strategies, such as flexible work hours and telecommuting, have tried to reduce congestion by diverting travel from the peak commuting hours.

While the service investments have been effective, they have not been enough (PSCOG 1990). Though transit and vanpool ridership has doubled since 1970, transit and vanpool capacity in 1990 represented a smaller portion of total daily travel than in 1970. In spite of emphasis placed on these programs, their relative benefit has declined because of the tremendous travel increase. Furthermore, these measures' potential benefits are limited by land-development practices and economics that encourage SOV travel. Residential densities have dropped 30 percent since 1970. Free, ample parking has been a feature of almost half of new jobs since 1970. During the 1980s, as travel expanded rapidly, the cost of owning and operating a car dropped. Finally, the same congestion that has slowed automobile travel has made transit less efficient and less reliable than ten years ago. If an investment in transit and HOV facilities is to be effective, it must be at a scale much greater than the investments of the past twenty years.

1.3.3 Options

One way to deal with the region's transportation problems would be to build new roadways, particularly freeways. A second option is to significantly increase the ability of public transit and HOVs to compete with SOVs. The Regional Transit Project is evaluating a combination of HOV lanes and rapid-transit alignments, due to their relative cost-effectiveness, lesser right-of-way requirements, and relative environmental benefits.

The Regional Transit Project is also proposing to increase transit efficiency and speed by improving bus access to the HOV system and identifying and removing "choke points" for public transit. To take advantage of increased speeds and efficiency created by the capital program and to bring passengers to the rapid transit system, there would also be a significant increase in and restructuring of transit service to better meet the region's transportation needs.

1.3.3.1 Comparative Cost-Effectiveness of Transportation Facilities

New transportation facilities needed to address transportation problems in the central Puget Sound region are likely to total several billion dollars over the next 30 years. Thus, alternative facility investments' cost-effectiveness will be a serious concern.

A facility's potential *cost-effectiveness* is measured by comparing cost to the number of users it serves at a time over a given distance. Cost-effectiveness depends on the ability to attract enough users to offset the initial capital cost of a facility. It thus is affected by the convenience to users:

o *Freeway lanes* remain effective up to volumes of about 2,000 vehicles per hour passing a single point. This capacity is reduced when roadways have closely spaced on- and off-ramps, curves, steep grades, or other constraining features. With an average of 1.2 persons per vehicle, one general-purpose freeway lane can effectively carry up to 2,400 persons per hour. The cost per passenger mile of freeway travel, based on average vehicle occupancies, changes little as travel volume increases - additional lanes must be added for about every 2,400 vehicles.

o Depending on the mix of vehicles (buses, vanpools, and carpools), an *HOV lane* has a wide range of theoretical capacities. The theoretical capacities are affected by the location of the facility (center or side of freeway) and the capital investment made in separation protection and access and egress facilities. A protected HOV lane used primarily by buses could carry upwards of 9,600 people per hour.

  For study purposes, the theoretical capacity was adjusted to reflect a traffic volume (vehicles per hour) that would maintain a speed advantage over the freeway lanes, the TSM capital investment made in exclusivity and access and ingress improvements, and the type of vehicles and average vehicle occupancy rates expected from the RTP projections of travel demand by mode. The resulting capacity estimates are 4,800 to 5,700 persons per hour. Assuming the mix of carpools, vanpools, and buses is constant, the range in capacity results from the minimum number of persons allowed for a carpool.

- *Rapid transit* can be much more cost-effective than freeway investments, provided that enough riders are attracted to the system. The theoretical capacity of a *busway*, or barrier-separated lane for exclusive bus use, is approximately 22,000 persons per hour in one direction past a single point. This equates to 560 buses per hour loaded with 40 persons per bus. However, use of this theoretical capacity would not accurately reflect the transit service or capital investment represented in the Transitway/TSM Alternative studied in this FEIS. Accommodating this volume of bus flow would require exclusive use of the transitway by buses, a transitway 47 feet wide (two lanes in each direction), a larger investment in entrance ramps, exit ramps, priority treatments, terminal facilities, center street capacity, and many more buses than are currently anticipated. After these factors have been adjusted for, the transitway lanes in the Transitway/TSM Alternative (single highway lanes with jersey concrete barriers) can accommodate a combination of buses, vans, and HOVs with a reliable capacity of approximately 9,400 persons per hour.

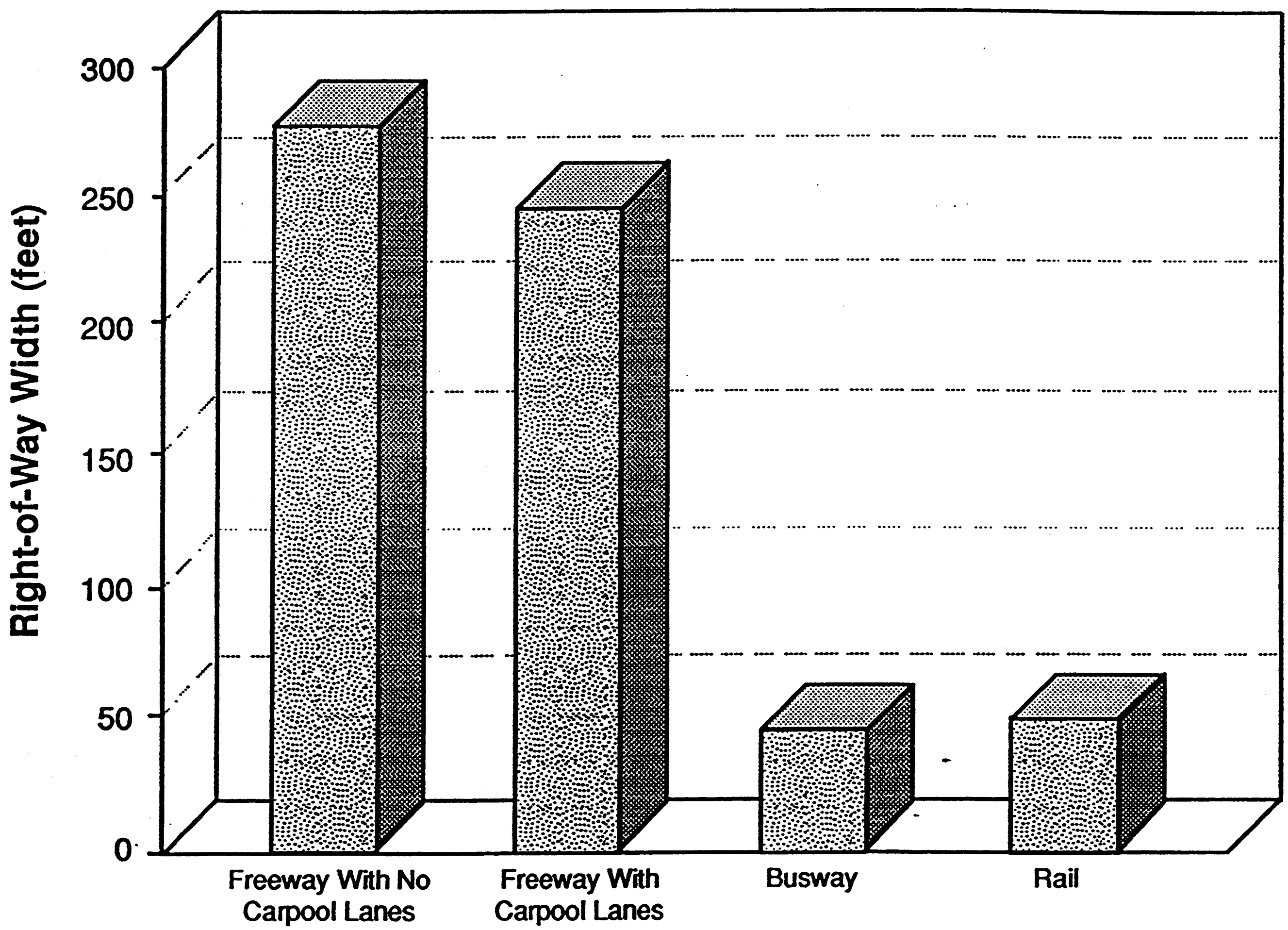
A *rapid rail* line with 4-car trains operating in exclusive right-of-way on 90 second headways has the capacity to carry over 22,000 persons per hour past a single point in each direction. The capacity is determined by multiplying the trains per hour times the number of cars per train times the number of people per car (40 trains per hour times 4 cars per train times 140 persons per car). These numbers represent the rail capacity of the downtown Seattle transit tunnel; capacity would be higher in segments with less frequent station stops. In comparison, the bus passenger capacity of the downtown Seattle transit tunnel is about 13,400 passengers per hour in each direction.

1.3.3.2 Comparative Right-of-Way Requirements

Any significant new transportation facility will require right-of-way, whether for automobile lanes, rail beds, busways, or HOV lanes. In a built-up urban area, right-of-way can be a significant percentage of the facility cost. The greater the amount of right-of-way required, the more businesses and residences that must be relocated and the more neighborhood disruption is likely. The wider the right-of-way required for a new facility, the greater the probability that the resulting displacement costs and neighborhood disruption will be unacceptable. In the comparison of right-of-way requirements that follows, the figures for right-of-way width represent typical cross-sections for the respective facilities. The figures are from one side of the facility to the other and do not include any easements or temporary right-of-way requirements needed during construction.

The land displacement of alternatives carrying higher-capacity vehicles would be less than the comparable displacement needed to increase freeway capacity for general-purpose traffic. To move 22,000 people per hour, a *freeway* carrying general-purpose traffic would require 18 lanes (9 in each direction). This requires approximately 270 feet of continuous right-of-way, expanding to well over 300 feet for access and exit ramps (Figure 1.3).

A freeway that includes an HOV lane in each direction requires 16 lanes or 246 feet of continuous right-of-way to move 22,000 people per hour. (Given



At-Grade Right-of-Way Requirements for 22,000 Riders per Hour

System Plan EIS

FIGURE 1.3

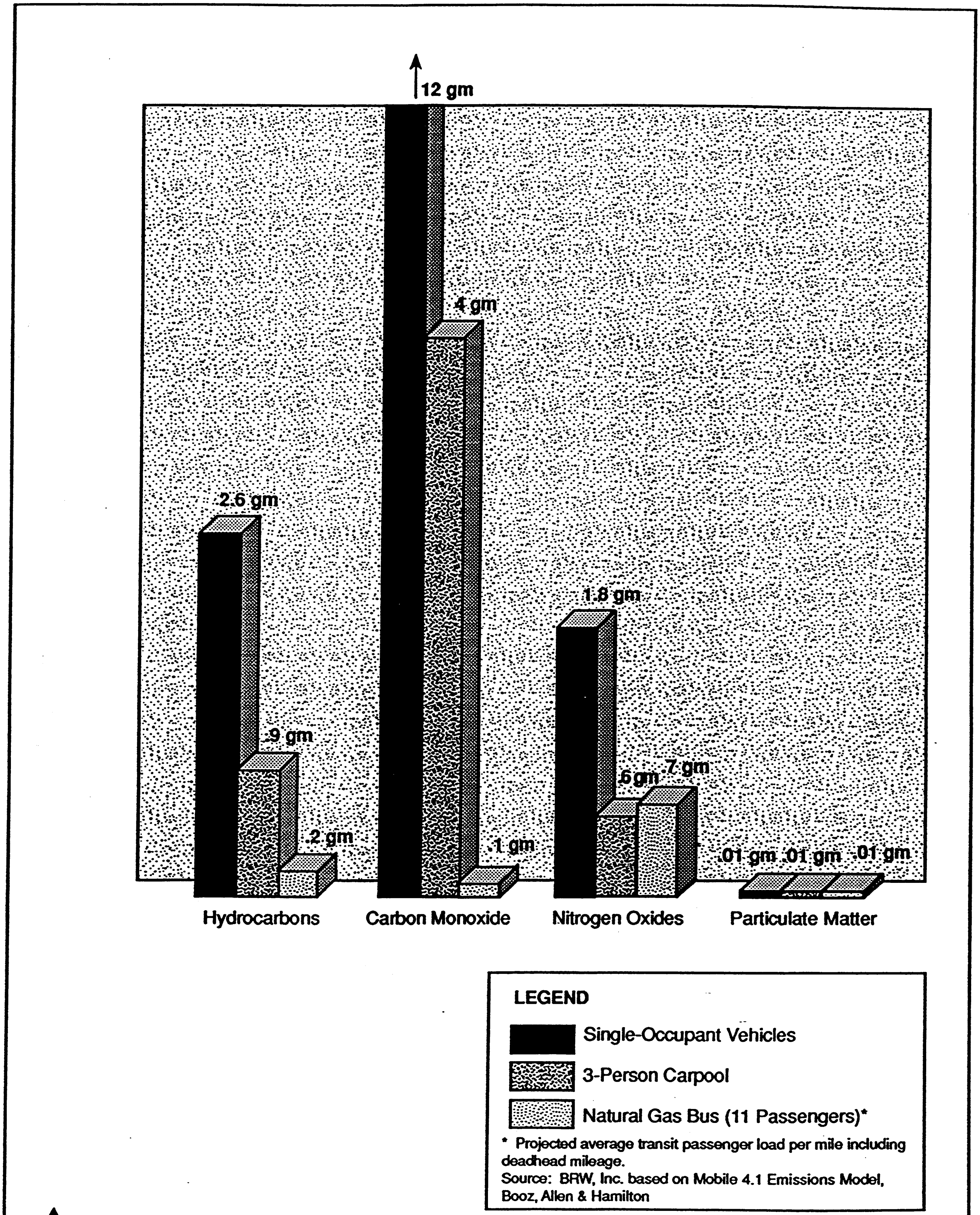
current automobile occupancies, one HOV lane in each direction would be sufficient to carry all HOVs.)

An *exclusive 2-lane busway* would require about 47 feet of right-of-way, expanding to 72 feet or more at stations. The cross-section through a busway typically includes a twelve-foot travel lane, a ten-foot shoulder for emergencies, and 1.5 feet of clearance from side obstructions. The resulting 23.5 feet increases to 47 feet when bidirectional travel is added. Off-line stations are required to maintain high capacity and result in a 72 foot cross-section: a twelve-foot travel lane, a twelve-foot bus loading lane, and a twelve-foot station platform, or 36 feet per direction.

A *rapid rail line* would require about 40 feet of continuous right-of-way, expanding to 60 feet or more at station areas. The cross-section through a double-tracked rapid rail line usually requires approximately fourteen feet from the centerline of one track to the centerline of the other track, which provides enough space to accommodate a catenary pole; seven feet of clearance from the centerline of each track to the edge of any obstruction, and an additional six feet for walkways, acoustical barriers, ditches, or walls, depending on the vertical profile. The 40 foot requirement for the line section expands to approximately a 60 feet minimum when a center or side station platform is added. *Commuter rail*, because it usually operates on existing railroad tracks, generally needs no new right-of-way. It is clear from the comparison that the displacement impacts of the higher capacity alternatives would be much less than the comparable displacement needed to increase freeway capacity.

1.3.3.3 Comparative Environmental Benefits

The option chosen to deal with our transportation problems will also affect air quality and energy use (Figures 1.4 and 1.5). Motor vehicles generate about 70 to 75 percent of total carbon monoxide emissions and 80 percent of the particulate matter polluting the region's air. Although emissions per passenger car have dropped significantly since the 1970s, growth in total vehicle miles traveled has diminished the air quality benefits of cleaner cars and is expected to contribute to a reversal of recent trends and increase aggregate vehicular emissions within the next 10 to 15 years. The Puget Sound region is currently in nonattainment status with respect to National Ambient Air Quality Standards for carbon monoxide, ozone, and particulate matter. It is estimated that in 2020 a person driving alone in a gasoline-powered car will generate an average of about 12 grams of carbon monoxide per mile, which is more than 100 times the expected average carbon monoxide emissions per passenger mile of a natural gas bus with the expected average occupancy of 11 people, factoring in deadhead miles. It is estimated that the same person in an SOV would generate approximately 2.5 times as much nitrogen oxides and 13 times as much hydrocarbon emissions as the expected per passenger mile emissions of a natural gas powered bus. Estimated average exhaust particulate emissions would be roughly equivalent per passenger mile for a gasoline-powered SOV and a natural gas powered bus. Estimated per passenger mile emissions of carbon monoxide and hydrocarbons from the exhausts of three-person carpools in gasoline-powered cars are significantly higher than for natural gas buses. Estimated per passenger mile particulate emissions from the exhausts of carpools and vanpools would probably be somewhat less than the overall average per



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2020 Estimated Potential Air Pollutant Production per Passenger Mile

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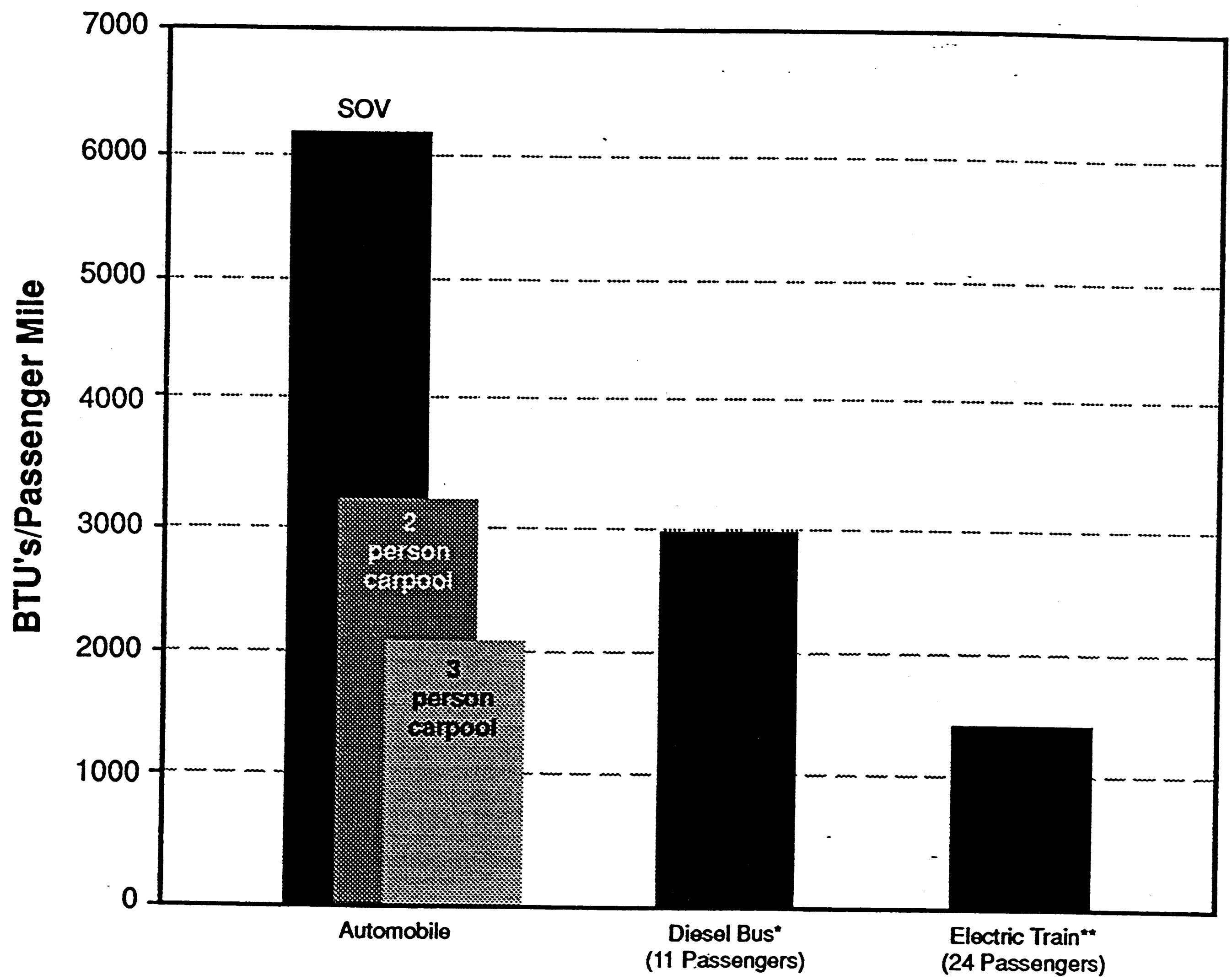
FIGURE 1.4



*At current average Metro passenger load.
**Average load projected for 2020.

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Energy Consumption by Mode

System Plan EIS

FIGURE 1.5

passenger mile emissions from the exhaust of a natural gas bus, although vehicular exhaust particulate emissions as a whole are expected to be quite low by weight in 2020. Individuals riding on electric trolley buses or electrically powered rail vehicles will not contribute to vehicle exhaust emissions, although there are likely to be some electrical power source emissions associated with the use of fossil fuel powered energy plants which contribute to regional electrical energy supply.

Similarly, the person traveling in an SOV requires about 6,200 BTUs of energy per mile; about 2,067 BTUs of energy by carpool; and about 3,775 BTUs of energy in a 40-foot bus with an average load. At peak hours, when transit vehicles are near capacity, energy use per passenger mile is typically half to two-thirds less. The choices we make will thus have major implications for our ability to control air pollution and conserve energy for years to come.

1.3.3.4 Growth and Transportation Demand Management

The Growth Management Act (HB 2929 and ESHB 1025; codified at Chapter 36.70A RCW) passed by the Washington State Legislature in 1990 requires consistency between land-use and transportation planning. In practice, this means that the transportation system must be capable of serving the land use, population, and employment of the region at a level of service acceptable to jurisdictions. The Growth Management Act also requires the region's counties to set urban growth boundaries. The thrust of the act is to promote higher-density development in the urban parts of the region and discourage growth beyond the urban boundary.

Similarly, PSCOG's (1990) regional plan, *Vision 2020*, proposes a regional growth management strategy that includes developing compact, well-defined communities, concentrating new employment growth into selected centers, providing higher-density residential areas, and containing urban area expansion.

Freeways and similar facilities aimed primarily at serving automobiles promote a dispersed, low-density growth pattern, particularly on the urban fringe. As a result, open space is being consumed at an alarming rate. Since 1970, while population grew by 30 percent, the amount of developed land in the region expanded by 80 percent. Growth management, as mandated by the State Legislature and developed in *Vision 2020*, encourages a change in the emphasis on the types of new transportation facilities developed in the future.

Rapid transit facilities promote more concentrated employment and residential densities than new freeways and arterials. In areas where there is efficient mass transit and appropriate zoning, businesses and families can cluster near transit facilities. Bus and rapid transit facilities are most successful where there are relatively high-density employment and housing areas. *Vision 2020* calls for a regional rapid transit system to support higher densities and policies and facilities promoting HOV use and discouraging single-occupant vehicle use.

In 1991, the State Legislature passed the Commute Trip Reduction Act, HB 1671, which provides that counties, cities, and towns must implement a commute trip reduction plan for major employers. The plan includes goals

for reduction of single-occupant commute trips and vehicle miles traveled (VMT) per employee. The law provides further support for policies that discourage SOVs and promote transit, HOVs, and bicycling and pedestrian modes, as well as alternatives such as telecommuting.

1.3.4 System Plan Purpose

The System Plan purpose is to present an effective rapid transit alternative to the problems associated with automobile use in the three-county region. It has also been developed in response to a King County vote in 1988 calling for expedited regional rapid transit planning.

Just implementing the System Plan will not solve congestion on the region's freeways and arterials or environmental problems associated with automobile use. It will, however, effectively provide mobility for people throughout the region without requiring them to depend on the congested freeway network. The System Plan proposes the following to increase public transit's efficiency and effectiveness:

- completing the freeway HOV system through a combination of federal, state, and local funding
- improving bus access to the HOV system
- identifying and removing transit "choke points" by giving buses priority at those points
- improving the public transit infrastructure
- substantially expanding bus service
- promoting transit-, bicycle-, and pedestrian-friendly land use in major transit corridors
- building a regional rapid transit system.

The System Plan will also support city and county measures enacted to manage growth and reduce automobile use to major employment and commercial centers. Finally, the System Plan's emphasis on public transit facilities provides more regional transportation capacity without requiring the amount of additional right-of-way or increased environmental impacts of adding comparable capacity for SOVs on regional roadways.

1.4 History of the System Plan

The following is a brief history of planning for rapid transit in the central Puget Sound region. Table 1.1 shows a chronology of the most significant events.

1.4.1 Forward Thrust

A rail system was first proposed in Seattle in 1968. The *Forward Thrust Public Transportation Plan* proposed a $385 million Metro general obligation bond issue to fund the local one-third share of a $1.155 billion coordinated bus/rail rapid transit system. The plan was one of 12 ballot elements of the proposed capital improvement program and was defeated in the 1968 Metro general obligation bond election. A comprehensive Public Transportation Plan and a financing plan for the Seattle metropolitan area to improve and increase public transportation in the region to 1985 and beyond was placed on the ballot again in 1970. The $440 million general obligation bond to fund a $1.321 billion bus and rail transit system was defeated.

Table 1.1. Regional Rapid Transit Planning Chronology.

Date	Significant Event
1968	Forward Thrust Public Transportation Plan. Proposed rapid transit bond issue failed
1970	Rapid transit bond issue failed
1981	PSCOG Light-Rail Transit (LRT) Feasibility Study. Concluded LRT was feasible; ranked corridors
1982	PSCOG adopted Regional Transportation Plan, including LRT recommendations
1984	North Corridor preliminary alternatives analysis initiated by PSCOG and Metro with UMTA funding support
1986	Multi-Corridor Project (MCP), joint PSCOG/Metro rapid transit alternatives analysis recommended rail planning to begin in 1993, rail system in operation by 2020
1986	North Corridor Extension Project by SNO-TRAN. Recommended LRT extension to Everett
1987	Tacoma-Seattle Transit Connections Project. Recommended LRT extension south to Tacoma
1987	Commuter Rail Feasibility Study.
1988	State Rail Commission Report. Recommended planning requirements, implementation authorities, and rail funding
1988	King County Advisory Ballot. King County voters support accelerated rail planning
1988	PSCOG advanced rail implementation schedule to begin operating by year 2000
1989	Metro Long-Range Plan scoping conducted
	Metro High-Capacity Transit Program begins
	Public Transportation Plan for Snohomish County
	Pierce County Transportation Plan Policy Document
1990	Expert Review Panel established
	High Capacity Transit Act passed
	Growth Management Act passed
	Transit agencies set up Joint Regional Policy Committee
	PSCOG adopts Vision 2020 Plan
	Vision 2020 Plan Draft and Final EIS issued
	Metro's draft Long-Range Plan prepared
1991	Scoping for Metro 2000 Plan
	Metro, Pierce Transit, and SNO-TRAN begin preparing regional transit system plan
	Commute Trip Reduction Act passed
1992	Draft Regional Transit System Plan and System Plan DEIS issued
1993	System Plan FEIS issued

1.4.2 Establishing Rapid Transit Feasibility

After the two votes failed, rail planning went into abeyance through the 1970s. Planning for a rapid rail system was revived by the Puget Sound Council of Governments (PSCOG) in its 1981 *Light-Rail Transit Feasibility Study*. The study concluded that light-rail transit could be feasible in the central Puget Sound region and ranked the region's high-volume traffic corridors by the probable feasibility and cost-effectiveness, as follows:

1. North Corridor and downtown Seattle, between downtown and Lynnwood
2. East Corridor from downtown Seattle to the north or northeast of Bellevue
3. South Corridor to south of Southcenter in a nonfreeway alignment
4. South Corridor to Tacoma
5. North Corridor to Everett.

The study recommended more detailed analysis of alignment alternatives. PSCOG adopted the recommendations in 1982 in the *Regional Transportation Plan.*

North Corridor preliminary alternatives analysis began in 1984 as a joint PSCOG-Metro effort, with partial funding from the Urban Mass Transit Administration (UMTA). The study recommended light-rail transit and advanced bus technology as preferred alternatives for the North Corridor. It also recommended a bus tunnel in downtown Seattle. The preferred alignment followed I-5. PSCOG adopted these recommendations.

Analysis of rapid transit alternatives continued in 1986 with the joint Metro-PSCOG Multi-Corridor Project (MCP). The project studied light-rail transit, bus trunk/feeder and baseline bus service in the three major corridors for the year 2020. The MCP recommended that a passenger rail system be in operation by the year 2020, but deferred further detailed rail planning until 1993 (PSCOG/Metro 1986). This schedule allowed for evaluating the effects of the Downtown Seattle Transit Tunnel and the new I-90 bridge, and completing major elements of the state HOV system elements before selecting an initial rail segment. The study recommended:

- Preparing a detailed public transportation plan through the year 2000
- Developing rail right-of-way preservation programs
- Promoting transit-supportive development by local governments.

Two other studies, SNO-TRAN's North Corridor Extension Project (SNO-TRAN 1986) in Snohomish County and the Pierce County Subregional Council's Tacoma-Seattle Transit Connections Project recommended light-rail extensions north to Everett along I-5 and south to Tacoma, respectively. The PSCOG Executive Board and the Metro Council endorsed the recommendations and those of the Multi-Corridor Project.

1.4.3 Metro's Long-Range Plan

Metro followed up on the Multi-Corridor Project recommendations in its Long-Range Plan program, evaluating transit alternatives for the 1990s. During the 1988 budget process, the Capital Program was amended to provide $1.1 million for planning right-of-way preservation, developing rail-convertibility standards, and conducting station-area analyses for potential station sites. Several factors made it clear that detailed rail planning needed to start before the recommended target date of 1993, including:

- The State Rail Development Commission assumed an earlier rail implementation schedule.

- Public surveys revealed an intense interest in rail technology.

- Legal analysis indicated that a successful right-of-way preservation program would require a policy decision on an initial segment.

- Major capital investments in key markets such as Bellevue and the University District needed to be coordinated with future rail investments.

- Capacity constraints outside of downtown Seattle needed to be addressed as soon as possible because of increasing congestion.

- Regional decisions regarding transportation investments in new roadways needed to be integrated with rail planning.

In response to these issues the Metro Council adopted Resolution No. 5502 on September 15, 1988. The resolution required Metro to help develop a three-county interagency coordination plan and recommended:

- Evaluating an initial rail and integrated bus system
- Beginning construction of an initial rapid-transit system by 1995.

1.4.4 Rapid Transit Planning

In 1988 the PSCOG Assembly adopted a policy to advance the planning schedule for rail to begin operating by 2000. PSCOG's *1990-2000 High-Capacity Transit System Plan* identified priority locations throughout the region for HOV facilities, passenger ferries, and rail and busway systems. In 1990 the State Legislature established a state high-capacity transportation program, which funded planning by local jurisdictions and tax mechanisms for paying for building a system. It required a planning process modeled on the alternatives analysis process prescribed by the UMTA (now the Federal Transit Administration or FTA).

In response, Metro modified its rapid-transit planning to begin alternatives analysis for a regional system, rather than only one transportation corridor. Potential alignments were screened for feasibility and environmental impacts. It was evident by spring 1991 that rapid-transit planning had to take place within the context of an overall regional transit plan. It also became apparent that the 20-year minimum specified by UMTA (now FTA) for alternatives analysis was not sufficient to analyze the proposed rapid-transit system's full extent and impacts. For these reasons, Metro put detailed alternatives analysis on hold until it could produce a comprehensive plan for regional transit through the year 2020. The System Plan is the result.

The Snohomish County Transportation Authority (SNO-TRAN) has been coordinating rapid transit planning within Snohomish County. In 1988, the jurisdictions situated along the I-5 corridor between the Snohomish/King County line and the City of Everett adopted an intergovernmental agreement pertaining to the preservation of right-of-way and associated land for a planned high capacity transit system within the I-5 corridor of Snohomish County. Since then a series of local station area studies have been completed to assist local jurisdictions in their consideration and evaluation of alternative sites for high capacity transit stations (SNO-TRAN 1987, 1988, 1989, 1990).

1.4.5 Recent Legislation Affecting Local Mass Transit

Growth Management Act

The 1990 Growth Management Act, *HB 2929 (codified as Chapter 36.70A RCW),* requires transit level of service (LOS) standards, plans complying with standards, and identification of expansion needs. The act also requires local jurisdictions to implement transportation demand management strategies, including measures to boost transit use. Transportation plans must be consistent with comprehensive plans and the transportation system must serve the

land use, population, and employment provided for in the comprehensive plan. The comprehensive plan must include an acquisition plan for transportation corridors. The 1991 amendments to the Growth Management Act, *HB 1025*, provides incentives for local governments to comply with HB 2929. The act also requires regional planning among Pierce, King, and Snohomish counties and coordinated transportation planning between counties and cities. See also Appendix F.

High Capacity Transit Legislation

HB 1825 - High Capacity Transit Funding and Planning established the joint regional policy committee (JRPC). The JRPC is responsible for preparing and adopting the high capacity transportation System Plan, to be reviewed by the expert review panel. The act encourages counties to adopt goals for reducing SOV use and provides taxing authority to accelerate HOV lane development and increase HOV use. *HB 1677 - High Capacity Transit Funding and Planning* details the funding, public involvement, and review requirements for use of state HCT funds. *HB 2151 - High Capacity Transit* details the process for coordination between agencies and local jurisdictions. *HB 2610 - Regional Transportation* defines the process by which two or more counties can establish a regional transit authority (RTA) to develop and operate a high capacity transit system. See also Appendix F.

Other Legislation

The *Federal Clean Air Act Amendments* require EPA to issue guidelines for transportation control measures for improved public transit, busways, and HOV lanes, employer-based transportation management plans, trip-reduction ordinances, providing high-occupancy, shared-ride services, and a phase-in of alternative fuel vehicles for auto and truck fleets. The amendments also require local transportation plans to include the purpose of eliminating and reducing air quality violations.

The *Intermodal Surface Transportation Efficiency Act* of 1991 (ISTEA) represents landmark transportation legislation with potentially far reaching implications for helping to achieve the objectives of the federal Clean Air Act. It requires coordination between the transportation and air quality planning processes, with flexible funding being provided to help urban areas develop and implement the transportation portions of State Implementation Plans. A $6 billion Congestion Mitigation and Air Quality Improvement Program is created to help implement projects and programs that will contribute to achieving attainment of the National Ambient Air Quality Standards. Urbanized areas over 200,000 population are designated as Transportation Demand Management Areas. Each such area is to have a congestion management system that provides for "use of travel demand reduction and operational management strategies."

The *Americans with Disabilities Act* (ADA) requires transit agencies to make their services accessible to people with disabilities or to provide substantially equivalent service for people who cannot be accommodated on the transit system. To meet the ADA requirements, transit agencies will be upgrading transit vehicles and loading facilities, buying new vehicles that provide substantially better access, designing transit centers and stations with access for people with disabilities in mind, and expanding their demand-responsive services to people with disabilities.

HB 1671 - Transportation Demand Management requires Washington counties, cities, and towns to implement a commute trip reduction plan for major employers. The plan includes goals for reduction of SOV commute trips and VMT per employee; designation of commute trip reduction zones; requirements for trip-reduction programs by major employers and public agencies; and parking policy revisions. The act allows civil penalties for employers who fail to implement or modify programs.

1.5 EIS Purpose

The System Plan EIS provides a programmatic review of the Regional Transit System Plan. Adoption of a System Plan preferred alternative will be a "nonproject" action, which is defined by SEPA as an action "different or broader than a single site-specific project" (WAC 197-11-774). More detailed study of the adopted alternative will take place in project-level analysis and environmental review. The System Plan EIS addresses the potential impacts of the alternatives on a regional and corridor-wide level. Review of localized impacts of the adopted alternative will be completed during the project-level phase.

Environmental review is being carried out at the programmatic level in the System Plan EIS for several reasons:

- Programmatic review allows a broader time frame and a larger system to be considered than procedurally possible under FTA's Alternatives Analysis process. Alternatives Analysis would consider impacts of an initial rail or transitway system. The System Plan EIS considers the expanded system that would be in place by the year 2020.

- Considering alternatives at the programmatic level allows evaluation to focus on the *types* of systems that could be built under each alternative, rather than the specific alignments and station locations. A two-stage environmental process allows regional transit agencies and the public to evaluate the relative merits of a rail, transitway, or TSM-based system and to agree on a particular system before committing resources to detailed engineering evaluation of alignments. It also allows full and timely consideration of how a multi-corridor system would operate as a whole, rather than just in isolated corridors.

- Subsequent project-level analysis and environmental review will focus on the environmental impacts of specific capital projects within the subregional corridors that are included in the adopted System Plan. In contrast, System Plan environmental review allows the transit system and transit alternatives to be considered as a whole.

1.6 Scope of the System Plan EIS

"Scoping" is a formal process for determining the range of proposed actions, alternatives and impacts to be discussed in an EIS. A "scoping process" includes publishing a brief project description, holding public meetings, and documenting the comments made by potentially affected agencies and the public.

1.6.1 Previous Scoping

System Plan environmental review has evolved out of previous planning efforts, most of which underwent their own scoping processes. Those planning efforts included the Pierce County Transportation Plan; SNO-TRAN's Public Transportation Plan for Snohomish County, Washington; Puget Sound Council of Government's (PSCOG's) Vision 2020 scoping, Draft Environmental Impact Statement, and Final Environmental Impact Statement; scoping for Metro's Long Range Plan, scoping for the Alternatives Analysis/Draft Environmental Impact Statement for Metro 2000, and supplemental scoping for the System Plan EIS. Public input for these plans covered the full range of actions, alternatives, impacts and issues considered in the System Plan EIS.

- The *Public Transportation Plan for Snohomish County, Washington* (SNO-TRAN 1989a) reviewed public transportation options for Snohomish County through the year 2020, including high-capacity transit. Many of the System Plan's proposals for Snohomish County are based on the Snohomish County plan recommendations. Public input on the document included written comments and testimony from a February 1989 public hearing. Public comments on this document were considered in defining the scope of the System Plan EIS.

- The *Pierce County Transportation Plan Policy Document* (Pierce County 1989) reviewed transportation options for Pierce County through the year 2020. The plan endorsed high-capacity transit and transit service expansion in Pierce County. The plan was reviewed in a draft and final EIS, and received public comments both in writing and at hearings on the draft EIS. Comments received during the scoping process and on the draft EIS relating to transit improvements and high-capacity transit were considered in defining the scope of the System Plan EIS.

- PSCOG's *Vision 2020* growth strategy and transportation plan for the central Puget Sound region (King, Kitsap, Pierce, and Snohomish counties) (PSCOG 1990) included a rapid transit system similar to that proposed by the System Plan in all but one of its build alternatives. The System Plan rapid transit alternatives are intended to support the Vision 2020 plan Preferred Alternative's land-use policies. Land-use and employment forecasts for ridership modeling were updated from PSCOG projections. Scoping for the Vision 2020 EIS took place in October 1989 (PSCOG 1989); the draft Environmental Impact Statement was issued in April 1990; and the final Environmental Impact Statement was issued in Summer 1990. Both the scoping comments and comments on the draft Environmental Impact Statement were considered in defining the scope of the System Plan EIS.

- Metro's *1990 Long-Range Plan*, an update of Metro's 1980 long-range plan, was a precursor to the current system planning effort. The Long-Range Plan, which was never completed or adopted, was to have covered the period 1990 to 2000, and in concept included most of the transportation systems management service elements now included in the System Plan. Scoping for the Long-Range Plan took place in Fall 1989. Comments from this scoping were considered in defining the scope for the System Plan EIS.

- *Metro 2000* scoping took place in February 1991. Scoping meetings were held in King and Snohomish counties to solicit comments on the scope of impacts of rapid-transit alternatives through the year 2010, as well as the Transportation System Management Alternative included in the System Plan (Metro 1991). As a result of this scoping effort and the public and agency comments received, it became evident that rapid transit planning had to be conducted within the context of an overall plan for regional transit. It also became evident that a longer planning horizon (through the year 2020, as opposed to 2010) was appropriate. Accordingly, the scope of the Metro 2000 plan was expanded to the scope of the present Regional Transit System Plan.

- *Supplemental scoping* for the System Plan EIS took place in May and June 1992 to allow agencies and the public to review plans for a 2020 system. Comments from this scoping were used to further define the System Plan EIS scope.

1.6.2 Scope of the Present Document

This environmental impact statement is a programmatic, nonproject EIS. As such, it is scoped to evaluate broad potential System Plan impacts. The scope of this EIS is based on the previous scoping and supplemental scoping conducted by Metro in the spring of 1992, as described above. In response to public and agency scoping comments, and consistent with the programmatic nature of the document, the EIS discusses the impacts and alternatives at a detail level consistent with issues addressed in the System Plan. The impact areas are regional. Issue areas addressed in the EIS and the general scope of analysis include:

Air Quality: regional air quality trends and conditions; regional automobile and transit emissions.

Noise: sources of noise associated with the alternatives; vibration from construction and operation; mitigation options.

Water Quality and Hydrology: regional runoff increases due to more impervious surface and water quality impacts of airborne pollutants that ultimately are carried into streams, lakes and Puget Sound.

Ecosystems: inventory of wetlands potentially affected in each corridor; likely impact.

Energy: each alternative's expected net added energy requirements; regional energy generation capacity; comparative energy efficiency of technologies; travel-related energy consumption of the alternatives; construction energy required.

Environmental Health: location and types of potentially hazardous sites; electromagnetic field effects.

Visual Quality: generic impacts of each alternative's infrastructure requirements and potential regional impacts.

Transportation: corridor-level traffic; transit ridership, accessibility, and efficiency; regional mobility and travel times; alternatives' capacity limits.

Land Use and Economics: alternatives' consistency with land use plans and policies; regional economic impacts; alternatives' generalized land-use effects; development supported by alternatives; potential property-acquisition process.

Parks: potential park infringement, impacts, process.

Historic/Cultural: historic and cultural resource locations; evaluation process.

1.6.3 Subsequent Project-Level Environmental Review

Following adoption of the System Plan, the adopted plan alternative will be evaluated in more detail during project-level environmental review. This step will review implementation of the adopted plan's policies and projects. The System Plan is a long-term, comprehensive regional transit plan that would be implemented over the next 30 years. As the plan is carried out, individual projects will be proposed and receive additional environmental review, as appropriate.

Detailed project-level environmental review will be carried out to address more specifically the adopted alternative's impacts. The following impact areas will be addressed:

- Energy
- Site-specific geology, soils, topography
- Air quality at specific station sites, park-and-ride lots, and problem areas
- Noise and vibration at specific locations from construction and operation
- Water quality and runoff impacts at specific locations
- Wetland, plants, and wildlife impacts in specific locations
- Station area development/redevelopment
- Displacement and relocation
- Specific neighborhood impacts
- Disruption at sensitive sites (i.e., schools or hospitals)
- Business displacement
- Visual impacts at specific locations
- Effects on particular parks and recreational areas
- Effects on specific historic, archaeological, or cultural resources
- Hazardous waste sites within alignment rights-of-way
- Congestion on specific arterials and near stations
- Transit dependent accessibility
- Transit service (e.g., travel times, feeder routes, routes eliminated/rerouted).

1.7 Screening of Rapid Transit Corridors and Alignments

The Puget Sound Council of Governments began assessing potential regional rapid transit alignments in 1982. The generalized alignments that are being considered in this EIS were evaluated and screened from a larger number of possible alignments. Each stage in the screening process has included public

meetings and involvement to ensure that the alignments were reasonable and met with public approval. RTP did not reevaluate all possible alignments for rapid transit. Rather, it built on earlier analyses in developing a set of reasonable alternatives for further study and environmental review. The evaluation process included several separate studies (Figures 1.6, 1.7, and 1.8):

- *The North Corridor Alternatives Analysis* (1982-1983) considered alignments between downtown Seattle and south Snohomish County
- *The Multi-Corridor Analysis* (1984-1986) considered potential alignments from downtown Seattle to Federal Way and east King County and further screened and evaluated alignments considered in the North Corridor Alternatives Analysis.
- *The North Corridor Extension Project* (1984-1986) considered rapid transit feasibility in Snohomish County. The analysis was further refined between 1986 and 1990.
- *The Tacoma Seattle Connections Project* (1985-1986) considered extensions of South Corridor alignments into Pierce County.
- Metro 2000 (1990) screened rail and busway alignments for 2010.
- Regional Transit Project (1991 to date) expanded Metro 2000 to 2020.

1.7.1 North Corridor Alternatives Analysis

The purpose of the North Corridor Alternatives Analysis was to determine the feasibility of transportation improvements, including rapid transit, in King County's North Corridor and to assess their costs and benefits. Screening was done by the Transportation Alternatives Analysis Steering Committee, an interagency committee of the PSCOG and Metro. Eight alignments were considered in the initial phase (PSCOG-Metro 1983). Three were carried into the second phase, and two survived that screening.

1.7.1.1 Public Involvement

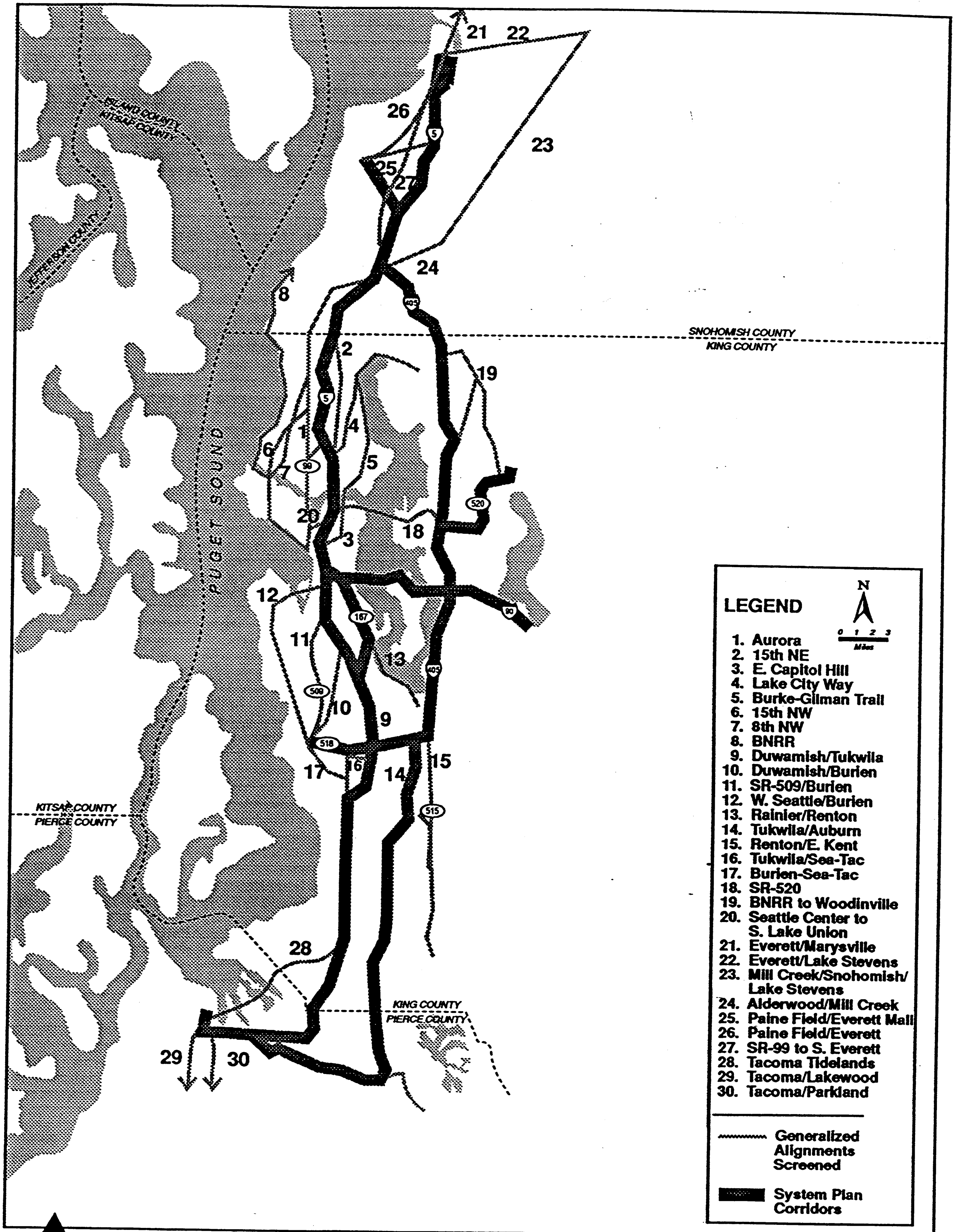
Project staff met with many business and community organizations, public agencies, and special interest groups. Community forums were held. Newsletters, brochures, fact sheets, and reports that were at the meetings were accompanied by a response form. Results of the questionnaires and meeting comments were presented to the Transportation Alternatives Analysis Steering Committee (PSCOG-Metro 1982).

1.7.1.2 Evaluation Criteria

First Phase (1982)

Alignments were evaluated for:

- cost
- accessibility to a feeder bus network
- impacts of construction
- service to activity centers
- distance from center of transit demand.



Regional Transit Project

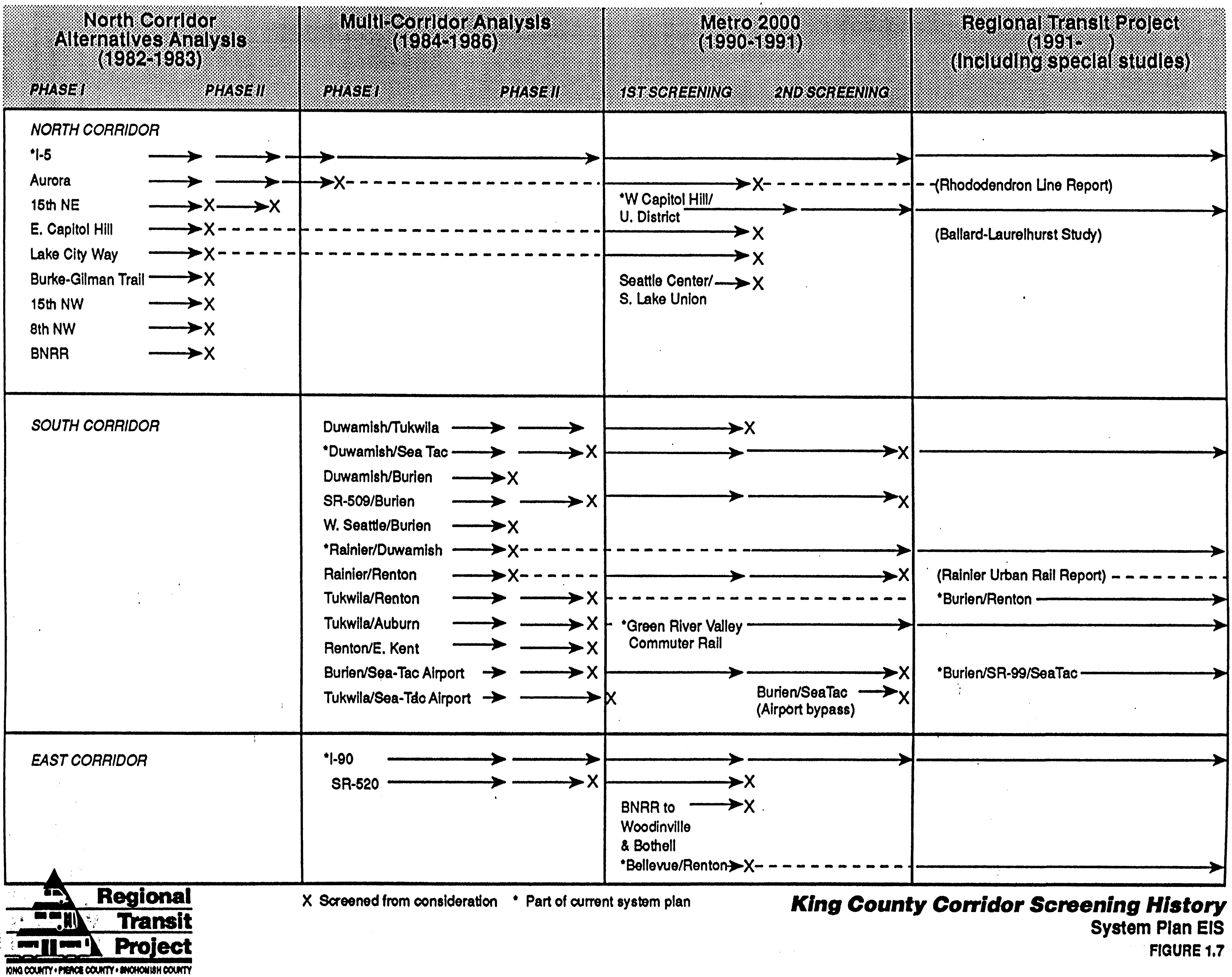
KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

RTPF0204C

Corridor Screening

System Plan EIS

FIGURE 1.6



King County Corridor Screening History
System Plan EIS
FIGURE 1.7

North Corridor Extension Project (1984-1986)

	PHASE I	PHASE II
Everett/Marysville	→ X	
Everett/Lake Stevens	→ X	
Mill Creek/Lake Stevens	→ X	
Alderwood/Mill Creek	→ X	
Paine Field/Everett Mall	→ X	
Paine Field/Everett	→	→ X
SR-99 to S. Everett	→ X	
*I-5 to S. Everett	→	→
*Alderwood/Paine Field	→	→

Tacoma-Seattle Transit Connections Study (1985-1987)

	PHASE I	PHASE II	PHASE III	
*Auburn/Puyallup/Tacoma	→	→	→	(Green River Valley Commuter Rail)
*S. Federal Way/Fife/Tacoma	→	→	→	
S. Federal Way/Tideflats/Tacoma	→ X			
Tacoma/Lakewood	→ X			
Tacoma/Parkland	→ X			

X Screened from consideration * Part of current system plan

Second Phase (1983)

Alignments were evaluated for the following characteristics:

- capacity
- service growth potential
- transportation plan compatibility
- costs
- land use and traffic impacts
- achievability
- potential for incremental development
- maximum use of public right-of-way

1.7.1.3 Alignments Considered

Alignments considered included:

I-5 from downtown Seattle to Lynnwood ("I-5"). This alignment would directly serve the Seattle CBD, University District, Northgate, and Alderwood Mall.

Aurora Avenue/Interurban from Seattle CBD to Lynnwood ("Aurora"). This alignment was proposed to promote development of the Aurora corridor.

Eastlake/15th NE/I-5 from Seattle CBD to Lynnwood ("15th NE"). This alignment would serve University District, Northgate, and Alderwood Mall.

Capitol Hill/Montlake/University District/Lake City Way ("Forward Thrust East"). This alignment was part of the 1970 Forward Thrust proposal.

Capitol Hill/Montlake/University District/Burke-Gilman Trail ("Burke-Gilman"). This alignment used right-of-way along the Burke-Gilman Trail.

Elliott/15th NW/Interurban to Lynnwood ("Forward Thrust West").

Elliott/15th NW/8th NW/Interurban ROW to Lynnwood ("Forward Thrust West Variation").

Burlington Northern, Seattle to Edmonds ("Burlington Northern ROW"). This alignment was thought to have relatively available right-of-way.

1.7.1.4 Recommendations

First Phase

The I-5, Aurora, and 15th NE alignments were recommended (PSCOG-Metro 1983). All had good feeder bus connections. The I-5 and 15th NE alignments served major activity centers and were near the center of transit demand. Aurora was considered to have good development potential.

Forward Thrust East was dropped because of cost, construction impacts, and inadequate bus feeder potential. Burke-Gilman was dropped for similar reasons, and because of existing use of the trail. Forward Thrust West and its

variation were screened out because of cost and limited bus feeder potential. The Burlington Northern ROW was screened out because it served no major activity center and was far from the center of transit demand.

Second Phase

I-5 was recommended because it was in the center of transit demand, served University District and Northgate, and would have minimal neighborhood impacts. However, it would likely take I-5 capacity.

Aurora was recommended for further study because it would have moderate neighborhood impacts, traffic impacts, and cost, and would leave HOV capacity on I-5. However, the corridor did not serve two major activity centers (University District and Northgate) and would not efficiently serve neighborhoods east of I-5.

The hybrid *Aurora/I-5* alignment was developed for further study because it would reduce the Aurora alignment's neighborhood and traffic impacts, while serving Northgate and avoiding impacts on I-5 capacity. However, it would have major construction impacts on north Green Lake neighborhoods and would not serve the University District.

The *15th NE* alignment was screened out because it would have severe neighborhood impacts and a very high cost.

1.7.2 Multi-Corridor Project

The Multi-Corridor project evaluated rapid transit in the North, South, and East Corridor Study Areas in King County under the policy guidance of the PSCOG-Metro Multi-Corridor Steering Committee. The North Corridor Alternatives Analysis was considered in evaluating North Corridor alignments. However, Aurora Avenue was not studied, due to lack of service to the University District.

1.7.2.1 Public Involvement

Project staff met with about 50 organizations, agencies, and interest groups during the Multi-Corridor Project. Fourteen forums were held in downtown Seattle, University District, north Seattle, Bellevue, Renton, Tukwila, Kent, Federal Way, and Shoreline. Results of questionnaires and comments from meetings and forums were presented to the Multi-Corridor Steering Committee (PSCOG-Metro 1986).

1.7.2.2 Evaluation Criteria

Phase I

Phase I sought to identify all possible alternatives and screen out the least promising. Criteria for evaluation (PSCOG-Metro 1985) included:

- Directness of service to potential transit users
- Directness of service to areas with highway capacity deficiencies
- Connections to and between major activity centers
- Compatibility with local plans

Phase II

Phase II analyzed the remaining alignments. Evaluation criteria included:

- o transit ridership
- o cost-effectiveness
- o maximizing operational safety and highway capacity
- o affordability
- o connections to and between activity centers
- o compatibility with land use plans
- o development opportunities near transit facilities
- o transit trips to major activity centers
- o transit service schedule reliability
- o significant environmental impacts

1.7.2.3 Generalized Alignments Evaluated

North Corridor

An I-5 alignment and one detouring to the UW campus were evaluated.

East Corridor

While alignments past Bellevue were evaluated, the main analysis focused on whether to serve downtown Bellevue by using SR-520 or I-90.

South Corridor

Because of the number of variations considered, it is easiest to discuss the South Corridor analysis in terms of links between centers that were considered. These included:

- o Seattle CBD/Duwamish employment centers to Tukwila
- o Seattle CBD/Duwamish employment centers to Sea-Tac Airport
- o Seattle CBD/Duwamish employment centers to Burien
- o Seattle CBD to Burien via SR-509
- o Seattle CBD to Burien via West Seattle
- o Seattle CBD/Rainier Valley to Duwamish employment centers
- o Seattle CBD/Rainier Valley to Renton
- o Tukwila to Renton
- o Tukwila to Auburn
- o Renton to East Kent
- o Burien to Sea-Tac Airport
- o Tukwila to Sea-Tac Airport

In Phase I, only options to Sea-Tac Airport, Tukwila, and Renton were considered in detail, although extensions further south were discussed. In Phase II, extensions to Federal Way, Auburn, and east Kent were added.

1.7.2.4 Recommendations

Phase I

Only East and South Corridor options were evaluated in Phase I.

East Corridor. Alignments not serving downtown Bellevue were dropped due to low ridership and lack of service to the largest Eastside activity center. Both SR-520 and I-90 alignments were recommended for further analysis.

South Corridor. The Duwamish/Tukwila, Tukwila/Renton, and Tukwila/Sea-Tac Airport links were carried forward because they would supplement highway capacity. The Duwamish/Sea-Tac Airport and Sea-Tac Airport via SR-509/Burien links were carried forward because they would serve major employment centers.

The Duwamish/Burien, West Seattle/Burien, Rainier/Renton and Rainier/Duwamish links were screened out because they would be too circuitous and slow for extensions into south King County. In addition, the analysis concluded that Rainier Valley links were too far east to allow efficient feeder bus service to western portions of the corridor.

Phase II

North Corridor. An I-5 alignment and the alignment serving the University campus were recommended for further analysis (PSCOG-Metro 1986).

East Corridor. The SR-520 crossing was dropped because of low ridership, lower feeder bus potential, higher cost, and lower cost-effectiveness compared to I-90.

South Corridor. An option serving the Duwamish area, Tukwila, Sea-Tac Airport, and Federal Way was selected because of ridership, bus feeder potential, and cost-effectiveness in serving the densest portions of the corridor.

1.7.3 North Corridor Extension Project (NEXT)

The NEXT project was a joint project of SNO-TRAN, Community Transit, Everett Transit, and PSCOG. The project started station area preplanning following a finding of feasibility in 1986. Four station area studies (1987-90) from Mountlake Terrace to Everett refined alignment and station options.

1.7.3.1 Public Involvement

Public involvement included the NEXT Newsletter; public meetings; group briefings; and regular presentations to city councils and planning commissions. Advisory committees of local government staff, local businesses, and elected officials also participated.

1.7.3.2 Evaluation Criteria

First Phase (1984-1986)

Alignments were evaluated for (SNO-TRAN 1986):

- Development at stations
- Environmental review
- Ridership and capacity measures
- Cost-effectiveness

- o User benefits
- o Feasibility
- o Public support.

Second Phase (1986)

Alignments were evaluated using the following measures:

- o Jobs/population within 1/2 mile
- o New employment/housing within 1/2 mile
- o Housing/businesses displaced
- o Roadway/traffic impacts
- o Construction impacts
- o Various environmental impacts
- o Pressures to change land use
- o Transit ridership/mode split
- o System capacity
- o Cost
- o Travel time savings
- o Quality of service
- o Availability of rights-of-way.

1.7.3.3 Alignments Considered

Alignments considered included:

<u>I-5 to Alderwood Mall</u>. This alignment from the North Corridor Alternatives Analysis was reexamined.

<u>I-5/SR-99</u>. This set of alignments studied I-5 to Lynnwood and from Lynnwood north to Everett via Paine Field, Everett Mall (I-5), and SR-99.

<u>Downtown Everett via I-5</u>. This alignment included a branch to Paine Field.

<u>Paine Field via I-5/SR-526 and via SR-525</u>. This set of alignments did not serve downtown Everett, ending at southwest Everett/Paine Field.

<u>Everett Mall/I-5, SR-99, SR-525/526</u>.

<u>Mill Creek via I-5 and 164th SW</u>. This alignment focused on southwest Snohomish County.

<u>Marysville via I-5</u>. This alignment extended north Marysville.

<u>Lake Stevens via I-5/SR-2 and SR-9</u>. One alternative used I-5 to Everett and then SR-2. The other alternative used SR-9 from Alderwood.

1.7.3.4 Recommendations

First Phase (1985)

Four alternatives were recommended for further study:

- o two "build" alternatives to downtown Everett via I-5 or Paine Field

- an all bus TSM Alternative
- a "No-Build" alternative.

Second Phase (1986)

Analysis of four alternatives and variants produced this recommendation:

The preferred alternative was rail in the I-5 corridor to downtown Everett. Additional study of Paine Field and east King County access was called for.

1.7.4 Tacoma-Seattle Transit Connections Study (Tac-Sea)

The Tacoma-Seattle Transit Connections Study was a joint project of Tacoma, Fife, Pierce Transit, Pierce County, WSDOT, and PSCOG. The objective was to develop a mid- and long-range plan for improved transit service between King and Pierce Counties.

1.7.4.1 Public Involvement

A citizens committee made up of business and public representatives provided input throughout the study. Community involvement also included a project newsletter, public meetings, attitude surveys, news releases, and presentations to community groups.

1.7.4.2 Evaluation Criteria

Phase I (1985-1986)

High-capacity transit alternatives were evaluated by the following measures:

- potential transit ridership
- potential availability of lower cost right-of-way
- economic development potential.

Phase II (1986)

Alignments to the Puyallup River were evaluated, mainly on the basis of cost.

Phase III (1986-1987)

There was no analysis of specific corridors or alignments in this phase.

1.7.4.3 Alignments Considered

Generalized alignments considered included:

Green River Valley through Puyallup to Tacoma.

S. Federal Way to Tacoma on I-5, SR-99, or the Interurban and 20th St. E.

S. Federal Way to Tacoma on SW 348th and the new SR-509.

Tacoma to Lakewood using I-5 or Tacoma Way South and I-5.

Tacoma to Parkland using SR-7.

1.7.4.4 Recommendations

In *Phase I*, the "I-5 corridor," including I-5, SR-99, and SR-509, was preferred over the Green/Puyallup River valley because of links to the preferred corridor in King County and higher ridership and population concentrations. The study concluded that transit ridership south of Tacoma Mall would not justify rail. *Phase 2 and 3* made no further alignment recommendations.

1.7.5 Metro 2000

Metro 2000 considered the recommended Multi-Corridor alignments, many alignments that had been dropped, and a few that had not been previously considered. Alignments were evaluated for both busway and rail lines. The Metro Council's Planning Subcommittee made screening decisions.

1.7.5.1 Public Involvement

Metro 2000 public involvement is described in Section 1.9. Alignment and corridor recommendations included input from meetings with the public, jurisdictions, and community and interest groups.

1.7.5.2 Evaluation Criteria

The criteria for evaluation of alignments (Metro 1990a) included:

- potential for growth and development along the corridor
- enhancement of mobility along the corridor
- efficiency of alignments along the corridor
- practicality of the alignment
- potential ridership
- cost-effectiveness
- community support
- possible advantage in financing
- environmental considerations
- consistency with Vision 2020 Plan

1.7.5.3 General Alignments Evaluated

North Corridor

North Corridor screening considered the Aurora, I-5, and Lake City Way corridors. Variations of the I-5 alignment served Capitol Hill/University District and Seattle Center. The Aurora and Lake City Way alignments were only considered for busways.

South Corridor

Phase I screening considered many Multi-Corridor links, including:

- o Duwamish/Tukwila
- o Duwamish/City of SeaTac
- o SR-509/Burien
- o Rainier/Renton
- o Burien/Sea-Tac Airport.

In addition, a link from Burien to SeaTac bypassing Sea-Tac Airport, a commuter rail line from downtown Seattle to Auburn, and the SR-99/I-5 corridor south of SeaTac were added. Phase II added a Rainier Valley/Duwamish industrial link.

East Corridor

Most of the recommended Multi-Corridor alignments were considered through Phase II, as well as variations. Added alignments linked Woodinville and Bothell to Totem Lake or Redmond on BNRR right-of-way and Bellevue to Renton in the I-405/BNRR corridor.

1.7.5.4 Recommendations

First Screening

North Corridor. The I-5 alignment and its west Capitol Hill/University District variation were recommended because of compatibility with the downtown transit tunnel, high ridership, and service to activity centers. The Seattle Center link was considered incompatible with the downtown transit tunnel and too expensive. An east Capitol Hill variation was dropped because of excessive grades, transit tunnel incompatibility, high cost, and circuitous routing (Metro 1990b). Aurora was screened out because it would not serve major activity centers, conflicted with the transit tunnel, and would have major traffic impacts. Lake City Way was screened out because it would not serve Northgate or the I-5 travel corridor and would have major traffic impacts.

South Corridor. Most of the alignments were recommended for further study. The Duwamish/Tukwila/Sea-Tac Airport corridor was screened out due to limited right-of-way and circuitous routing (Metro 1990b).

East Corridor. The I-405/BNRR corridor between Bellevue and Renton was screened out due to very low transit demand. The Woodinville/Totem Lake or Redmond alignment was dropped due to low densities, proximity to agricultural land and the urban growth boundary, and lack of service to the I-405 corridor (Metro 1990b).

Second Screening

The second screening revealed that busways would, in general, be more expensive and have lower capacity and ridership than comparable rail lines (see Section 2.6.1). The busway option was dramatically scaled back and designed to be a lower cost, possibly more flexible alternative to a rail system (the Transitway/TSM Alternative). Rail corridors were analyzed as described below.

North Corridor. Both alignments were carried forward for further analysis (Metro 1990c).

South Corridor. Recommended options assumed a commuter rail line in the Green River Valley. The first, Duwamish/SeaTac/Federal Way, directly served major activity centers at a relatively low cost, with good extensions to Tacoma. The second, Rainier Valley/SeaTac/Federal Way, served a major residential transit market, helped to alleviate Rainier Valley traffic congestion, and had positive land use impacts (Metro 1990c).

SR-509 to Burien and beyond was screened out for the following reasons:

- difficulties in crossing the Duwamish River at the First South Bridge
- failure to serve the Boeing Field employment center without serving a high-density residential area (e.g., Rainier Valley)
- more costly service and increased travel times to Sea-Tac and beyond
- more difficult bus connections without compensating ridership
- the ability of TSM to solve this SR-509's transit problems.

The Rainier/Renton corridor was dropped because of more circuitous routing to south King County and Pierce County than the Rainier/Duwamish link and because it would be even more expensive than the Rainier Valley option.

East Corridor. All the alignments and variations were recommended for further study (Metro 1990c).

1.7.6 Regional Transit Project (RTP)

RTP expanded Metro 2000 to serve major centers in King, Pierce, and Snohomish Counties by the year 2020. Metro 2000 alignments were extended past their previous termini using NEXT and Tac-Sea recommendations and some previously screened alignments were reexamined for their potential in a 2020 system. Alignment decisions will be made by the Joint Regional Policy Committee (JRPC).

General alignments added or extended by RTP include:

- I-5/SR-99 from Lynnwood to Everett
- Evergreen Way in Everett
- Airport Road from I-5 to Paine Field
- I-405 from I-5 in Snohomish County to Totem Lake
- I-90 from I-405 to Issaquah
- BNRR/I-405 from Bellevue to Renton
- BNRR/I-405/SR-518 from Renton to Burien
- I-5/SR-99 from Federal Way to Tacoma
- Extension of commuter rail to Tacoma.

These extensions were considered necessary to complete a regional system.

RTP studied two corridor alignment options for the North and South Corridors in Seattle. In the North Corridor, RTP compared an alignment serving First Hill and Capitol Hill with direct service to the University District with one serving south Lake Union, crossing the Ship Canal on the I-5 express lanes, and connecting to a people mover serving the University of Washington campus. In the South Corridor, RTP compared two alignments serving Rainier Valley and south Boeing Field (one on Rainier Avenue and the other on Martin Luther King, Jr. Way) with an alignment serving the Duwamish Industrial area. Based on the size of markets served and ridership

projections, the JRPC has recommended the North Corridor Capitol Hill alignment and the South Corridor Rainier/Martin Luther King, Jr. alignment and included them in the draft System Plan.

RTP has also studied potential additions, supplements, and variations to the regional rail system. These alignments are described in Section 2.3.

1.8 Existing Transit Plans

The No-Build Alternative does not, in all cases, reflect currently adopted transit service plans, due to FTA Alternative definitions and modeling constraints. Given past growth history, currently adopted 6-year TIPs (Transportation Improvement Plans) and 10-year TDPs (Transportation Development Plans), it is possible to estimate a more realistic and comparable alternative for comparison to other build alternatives. This baseline, however, is not presented in the FTA-required alternatives evaluation, but is presented briefly here for local review, evaluation, and discussion. Local transit agency service that is strictly local, or that does not provide service along regional transit corridors, has not been included in the alternatives evaluation model.

1.8.1 Metro

Metro's existing service has been included in the No-Build Alternative, based on the assumption that it will feed into the regional RTA service system. The Metro Long-Range Plan is pending adoption based on the direction of the Regional Transit Project.

1.8.2 Community Transit

Community Transit (CT) has an adopted 1990-2001 Comprehensive Plan, which indicates a reasonable response to projected growth. Given a 0.6% sales tax and motor vehicle excise tax (MVET) revenue, CT projects include fleet expansion and construction of new and replacement transit centers and park-and-rides, some of which may be at least partially funded by WSDOT.

Based on existing revenues and future policy decisions, a preliminary list of new transit centers, planned to be operational by the year 2020, have been identified. These include:

- Alderwood Mall
- Canyon Park
- Edmonds Community College
- Monroe
- Edmonds Ferry
- Frontier Village
- Marysville.

Park-and-rides may include:

- Mill Creek
- Tulalip (2 sites)
- Canyon Park
- Swamp Creek
- Monroe

- o Echo Lake
- o Maltby
- o Snohomish
- o Harbor Pointe
- o Arlington
- o Gold Bar
- o Sultan

Fleet Requirements

Given an annual growth rate of approximately 1.66 percent, as shown in CT's Comprehensive Plan, fleet size and service hours could approximate the following:

	1993	2001	2010	2020
Service Hours				
Local	154,549	176,306	204,464	241,059
Commuter	61,067	85,596	111,683	136,142
Paratransit	47,317	60,000	69,583	82,037
Vanpool	42,777	85,922	99,645	117,479
Fleet				
Local	101	122	142	167
Commuter	108	140	183	223
Paratransit	26	45	50	59
Vanpool	129	259	297	350

1.8.3 Everett Transit

Everett Transit's 1989-1999 Transit Development Plan includes service increases to respond to anticipated growth. Since adoption of that plan, additional growth is anticipated to respond to the Navy Homeport and the Boeing Everett Facility expansion. Most growth will occur in service hours and fleet size. Service expansion will include new routes as well as increased service frequencies.

	1993	2001	2010	2020
Service Hours				
Fixed Route	86,734	112,491	142,955	181,736
Demand Resp	11,405	16,193	23,590	32,582
Fleet				
Coaches	33	45	59	79
Vans	7	9	12	15

Transit centers may include:

- o Everett CBD (expansion)
- o Paine Field

Park-and-rides may include:

- Eastmont park-and-ride
- Everett park-and-ride

All Everett Transit service is currently described as "local" fixed-route, although some actually provides short-range commuter service to downtown Everett and to the South Everett employment center.

1.8.4 Pierce Transit

Pierce Transit now operates more service than what is reflected in the No-Build Alternative, which would feed directly into the regional system. Pierce Transit's recently developed System Plan (1992-2020) indicates demand for increases in all categories of service currently provided: Seattle/Olympia Express, local service, specialized transportation, and rideshare. In order to expand these services to meet 2020 demand, additional revenue will be required.

Primary existing revenue sources include MVET and a 0.3% local sales tax. The Pierce Transit Board is currently considering when and if to ask voters to approve the additional 0.3% local sales tax allowed by State law for public transit benefit associations (PTBAs). In the absence of additional revenue, the agency will follow a "No System-Wide Growth" alternative. The specific characteristics of this alternative will be determined through the development of service priorities that may lead to a reallocation of service resources.

Current levels that could be reallocated under a No-System-Wide Growth alternative are:

1992 LEVELS

Fixed Route		Demand Response	
Total Revenue Hours	488,409	Total Revenue Hours	88,890
Total Revenue Miles	7,260,000	Total Revenue Miles	1,659,000
Peak Buses	149	Vans	27
Total Buses	169	Vanpool	37

1.9 Public Involvement

The regional transit system planning process has included many opportunities for public participation to shape the plan. Public involvement activities are summarized below. There will also be significant opportunities for public involvement during the design, construction and implementation phases and associated environmental review.

1.9.1 Public Involvement Program Goals

The main goals of the ongoing public involvement and information effort are:

- Encourage public dialogue about the region's transportation needs
- Inform the public about transit alternatives and their impacts

- Involve citizens in shaping the System Plan and environmental review
- Elicit comments and ideas from the public at key decision points.
- Ensure that citizens are able to make an informed choice about the resulting long-range transit plan.

1.9.2 Public Involvement/Information Program Elements

The ongoing public involvement program includes the following elements:

- Public forums and meetings
- Community and interest group briefings
- Newspaper inserts and public information documents
- Media releases and briefings
- Discussion groups
- Public hearings
- Bimonthly newsletters
- Slide shows
- Public opinion surveys
- Citizens' advisory committee
- An arts program.

1.9.2.1 Discussion and Evaluation of Alternatives (Fall 1989 - Spring 1991)

The project's first phase focused on gathering comments from as many citizens as possible about system improvements and rapid transit alignments. In fall 1989, Metro issued a scoping notice for its Long-Range Plan to about 5,000 citizens, local jurisdictions, environmental organizations, and business and community groups. While the Long-Range Plan was never completed or adopted, the comments received by Metro were incorporated into the current planning effort.

Metro staff met with more than sixty community, business and public interest groups, presenting a rapid transit program overview, discussing alignments, and soliciting citizen comments. A citizen survey in the summer of 1990 identified public issues and concerns about transportation issues. At that time, Metro began a bimonthly project newsletter and involved the Citizens Transit Advisory Committee (CTAC) Planning Subcommittee in Metro Council Transit Planning Subcommittee deliberations.

In October 1990, nine broad-based public meetings were held in areas throughout King County for citizens to comment on the whole regional transit plan. About 550 people attended the forums.

In Snohomish County, 41 briefings were held by SNO-TRAN staff during the same period.

Comments received at meetings with organized groups, at public forums, and through the surveys helped the Metro Council's Planning Subcommittee and SNO-TRAN modify, eliminate and add rapid transit alignments in all three corridors. Once the recommendations were made, Metro also initiated Alternatives Analysis. In February 1991, Metro and SNO-TRAN held nine scoping meetings in King County and one in Snohomish County. The meetings (1) obtained more comments on the System Plan alternatives and (2) invited government agencies, citizens groups and the general public to

help define the range of alternatives and impacts that should be considered during project environmental review.

In April and May 1991, a three-county survey was conducted with 7,000 registered voters. It:

- assessed the support for public transportation system improvements
- identified the improvements the public desired and needed
- identified the preferred options for funding a regional rapid transit system and other transportation system improvements.

1.9.2.2 Draft System Plan Development (Summer 1991-Fall 1992)

In the second public involvement phase, regional transit agencies developed a draft System Plan describing an interconnected system of increased bus service, expanded high-occupancy-vehicle lanes on the interstate freeways and arterials, and a rapid transit rail system. This phase began with a series of meetings with representatives of various regional organizations and interest groups. Greater effort was made to work with local jurisdictions in reaching out to community groups, particularly as local jurisdictions began developing their comprehensive plans in compliance with growth management legislation. Outreach efforts both broadened and intensified as the planning became more specific.

Two public information/involvement efforts were undertaken during fall 1991:

- Outreach to community groups, business, and interest organizations was intensified.
- Public forums were held in October.

In King County, 13 public forums engaged citizens in a discussion of System Plan alternatives and available findings. Results were presented to the Metro Planning Subcommittee and to the JRPC for incorporation into the draft System Plan. In Snohomish County, a total of 33 briefings and nine community meetings were held. Also, during this period the Snohomish County JRPC Advisory Group of business and community leaders was established to advise the Snohomish County JRPC delegation. The advisory committee met twice a month.

In November and December 1991, an interim survey was conducted to get more input from citizens in the three-county region about funding preferences for regional transit system improvements. The survey was mailed to about 2,400 voters and followed up by telephone to get survey responses.

In winter 1991, the JRPC began making recommendations about the draft System Plan, including recommendations on:

- More service options
- Alignment alternatives in selected areas
- Technology options
- Funding alternatives
- Neighborhood links to the regional system.

The JRPC was provided summaries of citizen comments on each of the issue areas during its deliberations.

The draft System Plan and draft EIS were issued for comment in October 1992. In November 1992, Metro and the other regional transit agencies conducted hearings to gather public comment on the draft EIS (Table 1.2). An extended 45-day public comment period continued through November 30, 1992. A number of extensions to the comment period were granted on request. This final Environmental Impact Statement (FEIS), along with responses to all public and agency comments received on the draft EIS, is now being issued. The comments received on the draft EIS and draft System Plan will also be used by the JRPC to shape the final System Plan.

Table 1.2. Dates and Locations of DEIS Public Hearings, Community Meetings, and Open Houses.

Date (1992)	Community Mtng/ Open House*	Hearing	Location
Wed. Nov. 4	4-7 pm	7-9 pm	Ramada Inn Northgate
	7-9 pm*	-	Kales Jr High, Puyallup
Thu. Nov. 5	4-7 pm	7-9 pm	City Council Chamber Auburn
	7-9 pm*	-	Community Room Lakewood Mall
Mon. Nov. 9	4-5 pm	5-6 pm	Tacoma Library
	4-7 pm	7-9 pm	Triton Union, Edmonds Comm. Coll., Lynnwood
	4-7 pm	7-9 pm	Schafer Auditorium Seattle University
Tue. Nov. 10	11 am - 12:30 pm 2-6 pm	12:30-2 pm 6-8 pm	Conference Center Bellevue
	4-7 pm	7-9 pm	Tyee High School, SeaTac
Thu. Nov. 12	4-7 pm	7-9 pm	City Council Chamber Redmond
	4-7 pm	7-9 pm	San Juan Rm, West Coast Everett Pacific Hotel
Mon. Nov. 16	11 am - 12:30 pm 2-5:30 pm	12:30-2 pm 5:30-7:30 pm	Federal Building Auditorium, Seattle
Thu. Nov. 19	4-7 pm	7-9 pm	City Council Chamber Federal Way

*Events in Lakewood and Puyallup were community meetings; all others were open houses.

In the fall of 1992, a second survey was conducted to assess voter awareness and overall support for the recommended draft System Plan, refine existing understanding of voter preferences for financing mechanisms, understand how cost affects support for the system, examine voter preferences for options such as rail construction, HOV lane construction, and use of funds for additional transportation improvements, identify additional information the voting public may need before deciding whether to vote for or against building the system, and address particular issues of concern and interest to

the three counties participating in the survey. Approximately 2600 registered voters took part in a brief telephone survey. About 400 of those contacted in each county also participated in a second survey by mail.

The Regional Transit Authority and local transit providers will continue the public involvement process, providing input into the project-level environmental review, corridor and design hearings, conceptual engineering, and predesign project phases. Public meeting presentations, interest group discussions, media releases, and newsletters will help refine the alternatives and prepare voters to make an informed choice about the regional transit proposal. If voters approve continued work, regional transit agencies will involve the public through hearings on the project-level environmental review, at design meetings for specific alignments and station locations, and at meetings throughout construction.

1.10 Expert Review Panel

The Expert Review Panel is comprised of ten members and was mandated by the State of Washington High Capacity Transit Legislation. The panel is appointed by the Governor to provide independent oversight on the technical aspects of RTP planning, including ridership forecasting, cost estimating, and environmental analysis. Its members and the disciplines they represent are as follows:

Name	Association	Discipline
Aubrey Davis, Chair	President Emeritus, Group Health. Former UMTA Regional Administrator	Public Policy
John Basic	Boeing Company, Retired	Emerging Technologies
Maud Smith Daudon	Port of Seattle	Finance
David Hodge	University of Washington	Geography
Tom Matoff	Sacramento RTD	Rail/Bus Operations
Edward L. McLean	Construction Consultant	Engineering/Cost Estimating
Michael Meyer	Georgia Institute of Technology	Modeling/Planning
Gerrit Moore	Washington Environmental Council	Environment
Scott Rutherford	University of Washington	Engineering/Planning
Doug Wentworth	Sacramento RTD	Rail/HOV Planning/Finance

1.11 Decisionmaking Process and Criteria

Regional Transit Project planning is guided by the Joint Regional Policy Committee (JRPC). The JRPC is made up of King, Pierce, and Snohomish county elected officials from participating transit agencies, as well as the Secretary of WSDOT.

The JRPC has adopted goals and objectives for the RTP. RTP has four main goals. The first goal is to **ensure the ability to move around the region** by providing reliable, convenient, and safe public transportation services throughout the region. Strategies to reach this objective include:

- operate a public transit system that is reliable, affordable, accessible, safe, and attractive.
- take steps to create competitive advantages for transit by removing it from mixed traffic or giving it priority.

The second goal is to **preserve communities and open space** by supporting communities' ability to develop in ways that preserve and enhance their livability and limit intrusion into rural areas. Strategies to reach this objective include:

- reinforce desirable community characteristics.
- stimulate the development of desirable characteristics.

The third goal is to **improve the region's economic vitality** by increasing access to jobs, education, and other community resources. Strategies to achieve this objective include:

- improve transit access to jobs and other activities.
- provide services and facilities that benefit all socioeconomic groups.

The fourth goal is to **preserve environmental quality** by conserving land and energy resources and containing growth in air pollution. Strategies to achieve this objective include:

- reduce single-occupancy vehicle use.
- support Vision 2020 centers-oriented land use.

The choice of a recommended alternative will be based on a variety of criteria, including:

- effectiveness in increasing mobility
- the 2020 and phased system alternatives' cost and efficiency
- social, economic, and environmental impacts
- effects on regional equity
- financial feasibility
- consistency with the Vision 2020 plan.

Specific kinds of evaluation measures include:

- capital costs
- system ridership
- percentage of trips by transit, vanpool, or carpool
- travel time savings
- miles and hours traveled per day per person
- transit speed and reliability
- links between employment and residential areas
- ease of off-peak travel
- the farebox revenue that can be expected in relation to costs
- operating and maintenance costs
- ability to operate effectively in the built environment
- support for creation of pedestrian- and transit-friendly communities
- cost-effectiveness
- geographic and socioeconomic equity
- impacts on land use
- use of energy
- effect on air pollutant emissions
- environmental impacts
- affordability.

The RTP planning and decision-making process has several overlapping stages:

- System Planning. This current phase includes considering the transit plan for the entire region through the year 2020. Planning must include enough detail to be able to compare general alignments, markets served, and technology. When a decision is made on these issues, the System Plan recommended alternative and a financing plan will be placed on the ballot for voter approval. This recommended alternative may be based on one of the alternatives discussed in this FEIS, may consist of a combination of elements from two or more alternatives, or may consist of a scaled-back version of one alternative or a combination of alternatives.

- Project-Level Analysis. This phase includes corridor-level planning and hearings, as well as considering specific alignments and station locations and supporting TSM improvements for the adopted System Plan alternative. Alternatives will be considered in enough detail at the project level to make choices between specific alignments and profiles (e.g., tunnel, at-grade, or aerial) and approximate location of stations and other facilities.

- Preliminary Engineering and Design Review. This phase includes consideration of precise location and facility types, as they will be built, including review of designs and design hearings. Decisions will be made on specific mitigation measures for impacts identified in previous phases and on specific facility design details.

2.0 Alternatives

The System Plan alternatives represent a range of transit investment options. Each alternative includes a basic network of transit services and facilities and a particular technology emphasis. The criteria for choosing an alternative include projected ridership; percentage of trips made by transit, vanpool, or carpool; travel time savings, links between employment and residential areas, ease of off-peak travel; farebox revenue; operating and maintenance costs; cost-effectiveness; relationship to local and regional plans; and environmental impacts.

The No-Build Alternative is used as a baseline to evaluate the environmental impacts of the other alternatives. The Transportation Systems Management (TSM) Alternative is used to evaluate the cost-effectiveness of the capital-intensive Rail/TSM and Transitway/TSM Alternatives. The Transitway/TSM Alternative proposes a barrier-separated transitway in the region's core, as well as most of the TSM Alternative. The Rail/TSM Alternative proposes a rapid rail system serving the urbanized portion of the region, a commuter rail line in the Green River Valley, and the major portion of the TSM Alternative.

Alignments and station locations were developed for the alternatives for ridership modeling, system performance evaluation, generic environmental impact evaluation, and cost estimation. However, the alignments and facility locations do not include all those that could be evaluated in project-level review. Alternatives are described in terms of corridors. An alternative defined as the "Interstate 5 corridor" would be near, but not necessarily on, I-5. Specific alignments and facility locations will be defined and evaluated in project-level review.

A variety of agencies and funding sources would contribute. For example:

- Federal, state, and local funds would pay for freeway HOV lanes.
- Arterial HOV improvements would be developed and funded by local jurisdictions, WSDOT, transit agencies, and the federal government.
- Local transit operators would provide supporting bus services.
- A Regional Transit Authority (RTA) would construct and operate rapid transit services and related facilities with its own funds, as well as federal money.

2.1 No-Build Alternative

The No-Build Alternative limits capital investment to budgeted programs or programs necessary to maintain existing transit service levels. This is unrealistic, since service levels have historically grown by about two percent per year. Community Transit and Everett Transit have already planned to substantially increase future transit service (see Section 1.8). However, these unrealistic assumptions provide a baseline for evaluating environmental impacts of the alternatives. At the project level, the No-Build Alternative will meet Federal Transit Administration (FTA) requirements for alternative evaluation. As required by the FTA guidelines, the other alternatives include the background capital improvements assumed for the No-Build Alternative.

2.1.1 No-Build Concept

The No-Build Alternative assumes the baseline roadway network in 2020 (Figure 2.1), defined as:

- o Existing roadway network in 1990
- o Significant roadway projects that were under construction in 1990
- o Significant roadway projects that had funds allocated to them by 1990
- o Portions of WSDOT's HOV program budgeted by 1990.

The No-Build Alternative uses the existing 1991 transit network. Capital improvements are limited to projects under construction or in the current capital budget when the alternative was defined in 1990. Buses would be acquired to maintain existing service levels. The No-Build Alternative as defined does not include construction of new transit maintenance or operations facilities, but does include some needed expansion of current bases.

Supplemental Transportation Services

RTP agencies are committed to serving seniors and riders with disabilities. The Americans with Disabilities Act (ADA) requires the agencies to serve people with disabilities who are unable to use regular service. Under current plans, Metro will equip all buses with wheelchair lifts and offer door-to-door service at least 17 hours a day. Everett Transit will double its demand-responsive vans, increase service hours, and equip 60 percent of its buses with wheelchair lifts. Similar arrangements are being planned for Pierce and Community Transit. RTP would expand supplemental programs for low-income seniors and persons with disabilities by 25 percent beyond current plans. Supplemental services are the same under all alternatives, including the No-Build Alternative.

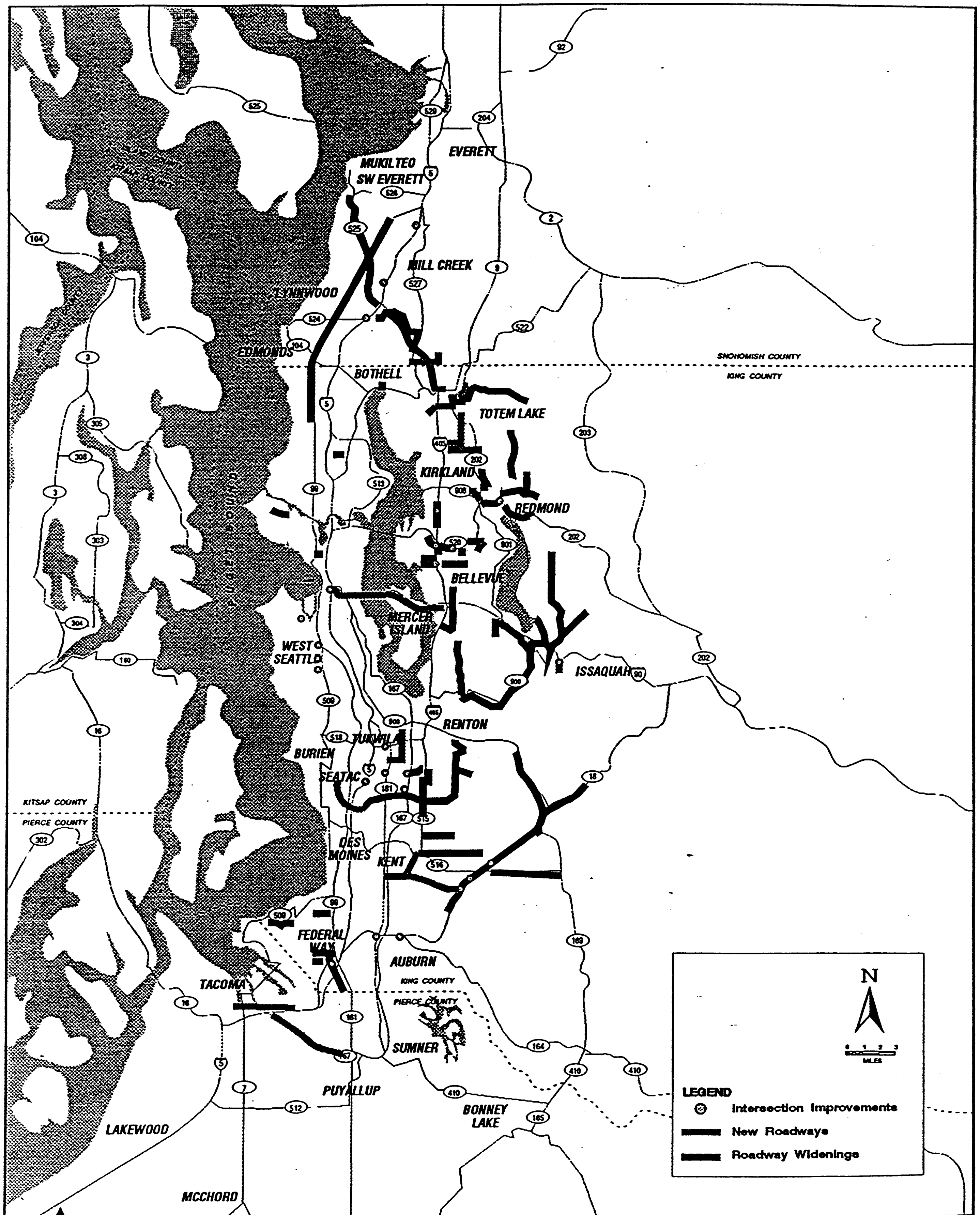
2.1.2 Transit Service Plan

No-Build transit service is based on the September 1991 service provided by Metro, Community Transit (CT), Everett Transit (ET), and Pierce Transit (PT) (Table 2.1). Service hours and miles were increased somewhat to compensate for schedule delays expected by 2020.

Table 2.1. Bus Service Characteristics by Alternative.

	1990		No-Build		TSM		Transitway/TSM		Rail/TSM	
	Average Weekday Platform Hours*	Average Weekday Platform Miles*	Average Weekday Platform Hours*	Average Weekday Platform Miles*	Average Weekday Platform Hours*	Average Weekday Platform Miles*	Average Weekday Platform Hours*	Average Weekday Platform Miles*	Average Weekday Platform Hours*	Average Weekday Platform Miles*
Community Transit	1.0	21.5	1.5	31.1	2.7	60.1	2.7	60.3	1.9	39.6
Everett Transit	0.3	4.0	0.4	5.5	0.8	11.9	0.8	11.9	0.5	7.4
Metro	8.8	125.3	10.0	130.5	15.7	234.0	15.8	244.3	14.0	184.7
Pierce Transit	1.5	23.6	1.7	25.8	1.9	29.2	1.9	29.3	1.5	23.2
Total	11.6	174.4	13.6	192.9	21.1	335.2	21.2	345.8	17.9	254.9

*Hours and Miles in thousands. Alternatives derived from factored results, as defined for purposes of ridership modeling. For information on existing and planned local service, see Section 1.8.
Platform hours are the number of hours that all or some of the coaches in the active fleet are in service. Platform miles are the number of miles traveled by all or some of the coaches in the active fleet within a given period of time.



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Background Highway Improvements

System Plan EIS

FIGURE 2.1

2.1.2.1 Community Transit

Community Transit will continue to operate fixed route, fixed schedule service in Snohomish County and to destinations in King County, including:

- o Commuter service to downtown Seattle, Bellevue, and Redmond
- o Express service to the University of Washington main campus
- o Local suburban service in Snohomish County, as well as to Aurora Village and downtown Bothell
- o Local rural service to major Snohomish County centers
- o In-county commuter service to major employers
- o Dial-a-ride and other demand-responsive paratransit services.

2.1.2.2 Everett Transit

Everett Transit will continue to provide service within the Everett city limits and the urban service area (just outside city limits) in Snohomish County. Everett Transit service also includes:

- o Dial-a-Ride service
- o commuter service to the Everett Boeing facility
- o suburban service to local centers.

2.1.2.3 Metro

Metro will continue to operate a range of King County services, including:

- o Local service on surface streets and arterials
- o Express service, generally commuter-oriented and limited to the peak period in the peak direction
- o Custom subscription service to employment centers and schools
- o Fixed-route paratransit service in areas of low population densities
- o Dial-a-ride and other demand-responsive paratransit services.

2.1.2.4 Pierce Transit

Pierce Transit will serve Pierce and King county destinations, including:

- o Express freeway routes to downtown Seattle from Pierce County
- o Local routes in Pierce County and to Federal Way and Enumclaw
- o Demand-responsive service from low-density communities .

2.1.2.5 Costs

No-Build Alternative capital costs would be $1.2 billion (1991 dollars). Operating and maintenance costs would be $274 million per year (Table 2.2).

Table 2.2. Operating and Maintenance Costs for Each Alternative.

Alternative	Cost Millions of 1991 $
No-Build	
Community Transit	34
Everett Transit	6
Metro	201
Pierce Transit	35
Total	274
TSM	
Community Transit	57
Everett Transit	11
Metro	291
Pierce Transit	38
Total	399
Transitway/TSM	
Community Transit	57
Everett Transit	11
Metro	298
Pierce Transit	38
Total	406
Rail/TSM	
Rail System	159
Commuter Rail	10
Bus System	
Community Transit	43
Everett Transit	8
Metro	251
Pierce Transit	31
Total	492

Source: Manuel Padron 1992.

2.1.3 Anticipated Capital Facility Improvements

Fleet Size and Composition

Fleet sizes for 2020 were developed for costing purposes. The fleets were based on peak-hour service needs and necessary spares. By 2020, all buses would satisfy 1998 fleet emissions requirements under the 1990 Clean Air Act Amendments. Metro and Pierce Transit are already committed to using alternative fuels, such as compressed or liquefied natural gas. Community Transit and Everett Transit would probably also use alternative fuels. Table 2.3 gives a breakdown of the various fleets for regional service. This table does not include local demand-responsive and paratransit service, as well as some CT, ET, and PT local service. See Section 1.8 for CT, ET, and PT local fleet levels.

Table 2.3 Conceptual 2020 Fleet Compositions.

Operator	Vehicle Type	Number of Vehicles in Model*: No-Build Alternative	TSM Alternative	Transitway/TSM Alternative	Rail/TSM Alternative
Community Transit	Bus	233	382	384	285
Everett Transit	Bus	42	82	82	56
Metro	Bus	1,014	1,173	1,177	1,601
	Trolley	138	223	223	237
	Dual-Powered	236	556	572	0
	Streetcar	5	5	5	5
Pierce Transit	Bus	194	211	211	172
Regional Transit Authority	Rapid Rail Transit Car	0	0	0	387
	Commuter Rail Car	0	0	0	50
	Locomotive	0	0	0	11
Total		1,862	2,632	2,654	2,804

*Represents only vehicle needs for comparison of alternatives and ridership results. Results are factored for constrained ridership and operations/maintenance cost calculations. CT, ET, and PT would have additional buses as needed for local service. For actual local service plans of these agencies, see Section 1.8.

In addition, approximately 370 shuttle vans would operate in King County, 150 in Pierce County, and 160 in Snohomish County. The vanpool fleet would expand to 1,710 vans in King County, 700 vans in Pierce County, and 730 vans in Snohomish County. Because vanpool demand is mainly affected by marketing and transportation demand management measures, the program is the same under all alternatives.

Assumed Highway Network Improvements by Other Jurisdictions

North Corridor. Capacity improvements include interchange modifications along I-5 and Interstate 405, additional lanes on State Route 99, State Route 525, and 196th Street Southwest in Snohomish County and on Emerson Place and Northgate Way in the City of Seattle, and extension of Broad Street in the City of Seattle (see Technical Appendix A). The No-Build Alternative was defined before the $47 million Boeing transportation mitigation package was negotiated for Southwest Everett and does not include those improvements.

South Corridor. Improvements include new arterials in south King County; new interchanges on I-5 at Sea-Tac and State Route 161; capacity improvements on I-5 and SR-18; widening of existing arterials; connection of State Route 167 with I-5; a freeway (SR-509) across the Tacoma tideflats; new interchanges along State Route 18; and a second bridge with HOV lanes over the Duwamish River at First Avenue South (see Technical Appendix A).

East Corridor. Improvements include rebuilding the collapsed Interstate 90 bridge over Lake Washington; new interchanges on State Route 520; conver-

sion of Northeast 8th Street and Northeast 10th Street in Bellevue into one-way couplets; widening portions of I-405, State Route 900, SR-202, State Route 527, and several arterials; new arterials; and modification of interchanges on I-405 and SR-520 (see Technical Appendix A).

HOV Network Improvements

South Corridor. HOV projects being completed include median lanes on portions of I-5.

East Corridor. When the I-90 bridge is rebuilt, the center roadway will provide reversible HOV lanes.

2.2 Build Alternatives

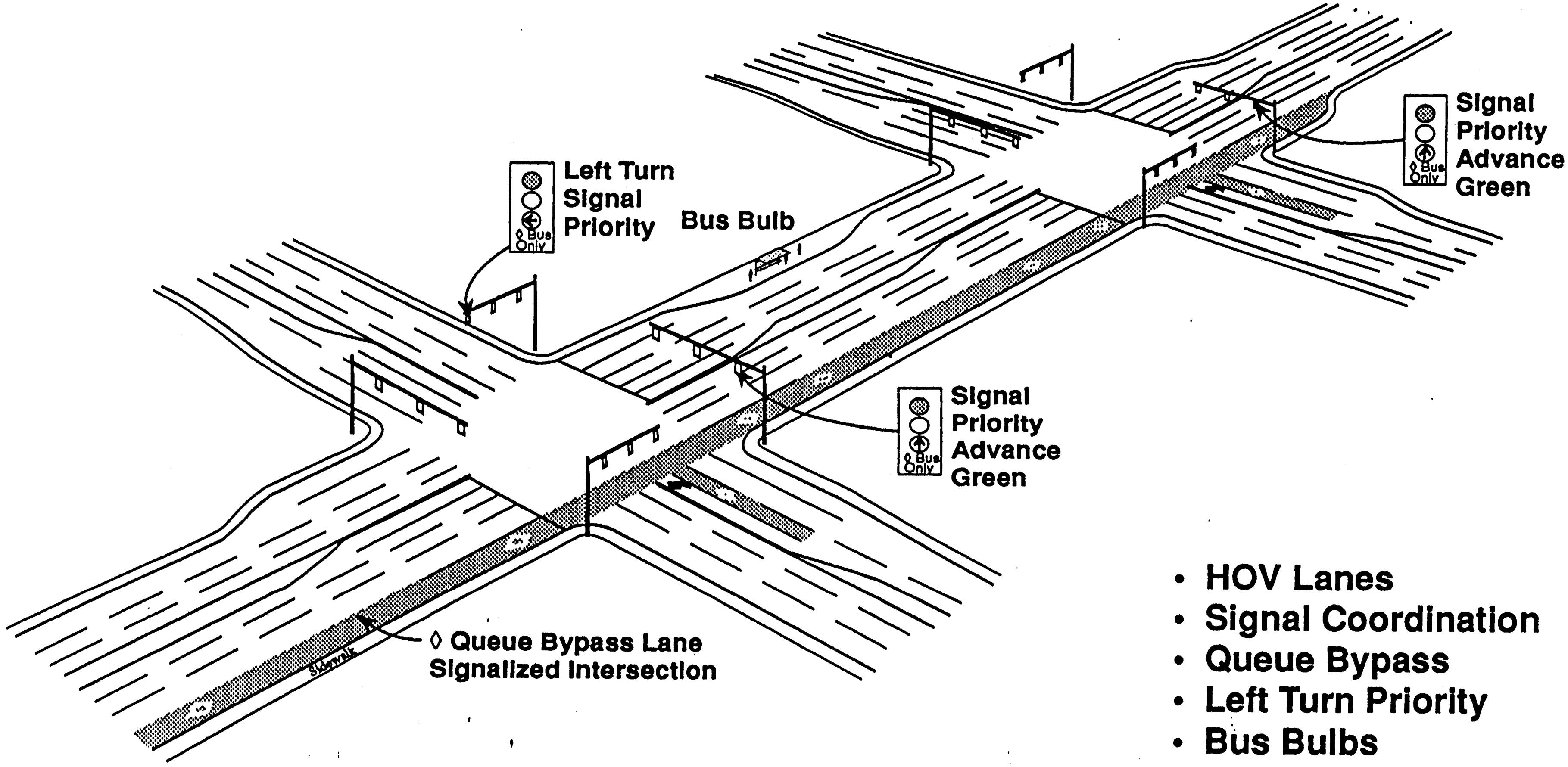
Three build alternatives involving extensive service expansion and capital investment are considered in this EIS (Table 2.4). All three alternatives have as a common base a set of Transportation Systems Management (TSM) measures, as described below. Each build alternative was developed based on initial assumptions about service hours and associated fleet levels. However, the ridership model for the build alternatives was structured to allow adjustment of service hours and fleet sizes to meet demand, as reflected in the ridership model. The service hours and fleet sizes reported in Tables 2.1 and 2.3 reflect these adjustments.

Concepts Common to the Build Alternatives

All three build alternatives include Transportation Systems Management (TSM) measures. These measures would increase regional and community transit service to and between Vision 2020 centers. Service improvements include all-day and more frequent two-way service, with increased connections to the regional system and between regional and other centers. Improved transit centers and new park-and-ride spaces would accommodate the proposed service expansion.

Regional TSM capital improvements would complete, expand, and enhance WSDOT's freeway diamond lane network, adding projects from *Vision 2020* to improve transit speed and reliability. TSM would provide better access to freeway HOV lanes and give HOVs priority on key arterial links to transit stations and park-and-ride lots. WSDOT would complete a freeway control and driver information system to monitor traffic flow, provide drivers information on congestion, and rapidly respond to incidents. Priority would be given to transit/HOV operations to by-pass congestion.

Community TSM capital improvements would increase the security, convenience, reliability and speed of transit/HOV operations. Improvements include passenger facilities and transit centers, intersection by-pass lanes and priority signalization, lighting, landscaping, widened sidewalks, and arterial HOV/transit lane development (Figure 2.2).



- HOV Lanes
- Signal Coordination
- Queue Bypass
- Left Turn Priority
- Bus Bulbs

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Typical Priority Treatments on Arterial Streets
System Plan EIS
FIGURE 2.2

Table 2.4. Components of the Three Build Alternatives.

	Alternative		
	TSM	Transitway /TSM	Rail/TSM
Capital Projects to Improve Regional Service			
New Freeway HOV Lanes	384 Lane Miles	384 Lane Miles	384 Lane Miles
Highway and arterial HOV and transit improvements	Yes	Yes	Yes
Transitway System	No	Yes	No
Rail System	No	No	Yes
Commuter Rail Line from Seattle to Tacoma	No	No	Yes
New Stations	0	10	78
New Park-and-Ride Stalls	14,000	14,000	38,000
New Bus Maintenance Bases	4	4	3
Regional Service Improvements			
Expanded system of regional express bus routes	Yes	Yes	Interim Only
Rail system service	No	No	Yes
Commuter rail service	No	No	Yes
Local Service Improvements			
Expanded local/express bus routes and service	Yes	Yes	Yes
Expanded local feeder bus service	Yes	Yes	Yes
Expanded demand-responsive service	Yes	Yes	Yes
Expanded service for elderly and people with disabilities	Yes	Yes	Yes
Expanded vanpool program	Yes	Yes	Yes
Bicycle/Pedestrian Improvements			
Improved bicycle access to transit	Yes	Yes	Yes
Increased bicycle transport on transit	Yes	Yes	Yes
Increased pedestrian amenities and access at transit hubs and along transit corridors	Yes	Yes	Yes

Some arterial HOV treatments are on roadways feeding the regional HOV system. Other arterials that support intense all-day transit operations are candidates for a range of TSM improvements.

Bicycle Access Improvements would be integrated into the transit system under all three build alternatives. Access improvements would include improved bicycle access to transit centers and stations; improved bicycle lock-up facilities at stations; carrying bicycles on transit vehicles where feasible; including improvements for safe bicycle travel on arterials; and working with local jurisdictions to identify and improve bicycle connections with transit.

Transportation Demand Management

The efforts of local jurisdictions to implement the State's Commute Trip Reduction Act (CTRA) will increase the link between land use and transit. CTRA will enable local jurisdictions to reduce SOV demand by offering incentives for ridesharing and disincentives for parking and driving SOVs. The aggressive TSM transit program, as well as the ridematching and vanpool program in all the alternatives, helps achieve the objectives of the CTRA.

Transit agencies would continue to work with employers and local jurisdictions to increase the viability of transit and reduce traffic congestion through transportation demand management (TDM) measures, including:

- o alternative work hour programs
- o guaranteed ride home programs
- o subsidies for transit passes
- o subsidies for employees who carpool
- o site plans that facilitate pedestrian access to transit and carpooling
- o providing bicycle parking and access facilities
- o preferential parking for HOVs
- o parking charges for SOVs
- o giving transit investment priority to areas undertaking significant demand-management measures.

Transit Service Plans Common to the Build Alternatives

This section describes how TSM service improvements could be developed for the period from 1991 to 2020. Actual TSM service improvements would be based on future subarea planning carried out with local jurisdictions.

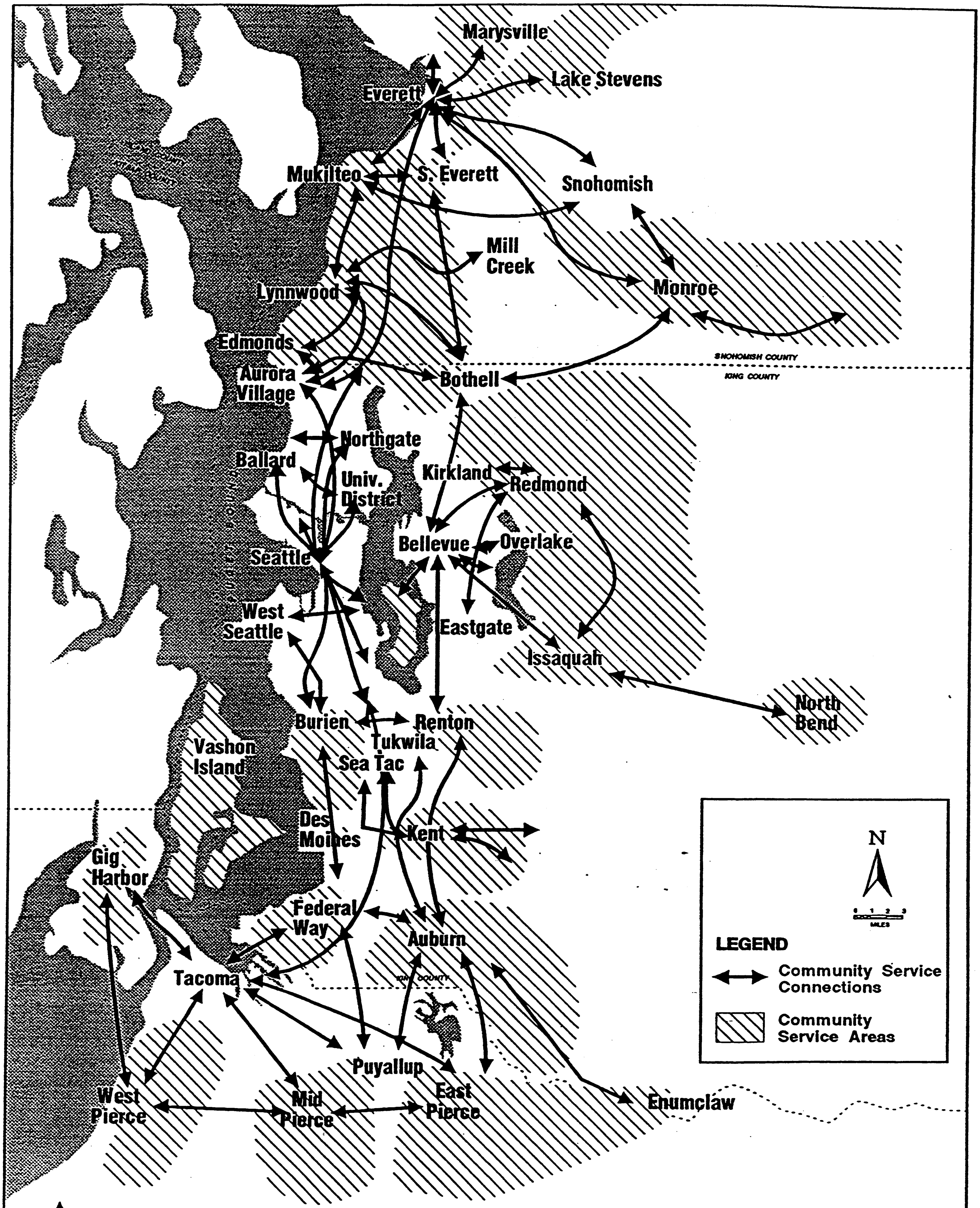
Service Orientation. The TSM service plan increases service convenience and frequency, community-based services, and access to centers.

Community Service Structure. The all-day TSM community service concept (Figure 2.3) links communities and centers to the regional system and helps people move around their communities by improving transit connections and frequency. The concept includes:

- o Linking centers with the regional network and improving transit mobility within communities;
- o High-frequency community bus routes on primary arterials between dense urban neighborhoods and along suburban arterials with pedestrian-oriented development stimulating high ridership;
- o Quick, convenient routes serving lower-density communities
- o Flexible transit services (shuttle services, DART, route deviation, etc.) serving dispersed communities and special transportation needs.

Service Supported by Transit-Oriented Land Use. The high-frequency, community-based service outlined above would be supported by encouraging transit-oriented land use. This includes:

- o Mixed use housing, retail, offices, schools, and other uses highly oriented to transit
- o Moderate densities
- o Clustering of activities within walking distance of transit stops



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TSM Community Service Concept

System Plan EIS

FIGURE 2.3

- Parking controls
- Pedestrian-oriented site design.

Other Supportive Service Elements. Expansion of ridematching programs, vanpools services, and supplemental programs for seniors and the disabled, as proposed under the No-Build Alternative, would augment the TSM service concept.

Capital Elements Common to the Build Alternatives

The TSM service plan would need systemwide capital improvements as well as supportive regional and local improvements within each corridor. Because final identification and evaluation of TSM facilities will occur during project-level planning, the facilities and locations described as part of this alternative are only illustrative, for purposes of system evaluation.

Systemwide Capital Elements. Systemwide capital elements include infrastructure to support significant expansions in service: bus fleet, maintenance bases, vanpool and shuttle vans, computer systems, passenger shelters, traffic flow and safety improvements, and other projects (see Technical Appendix B). Systemwide capital elements also include:

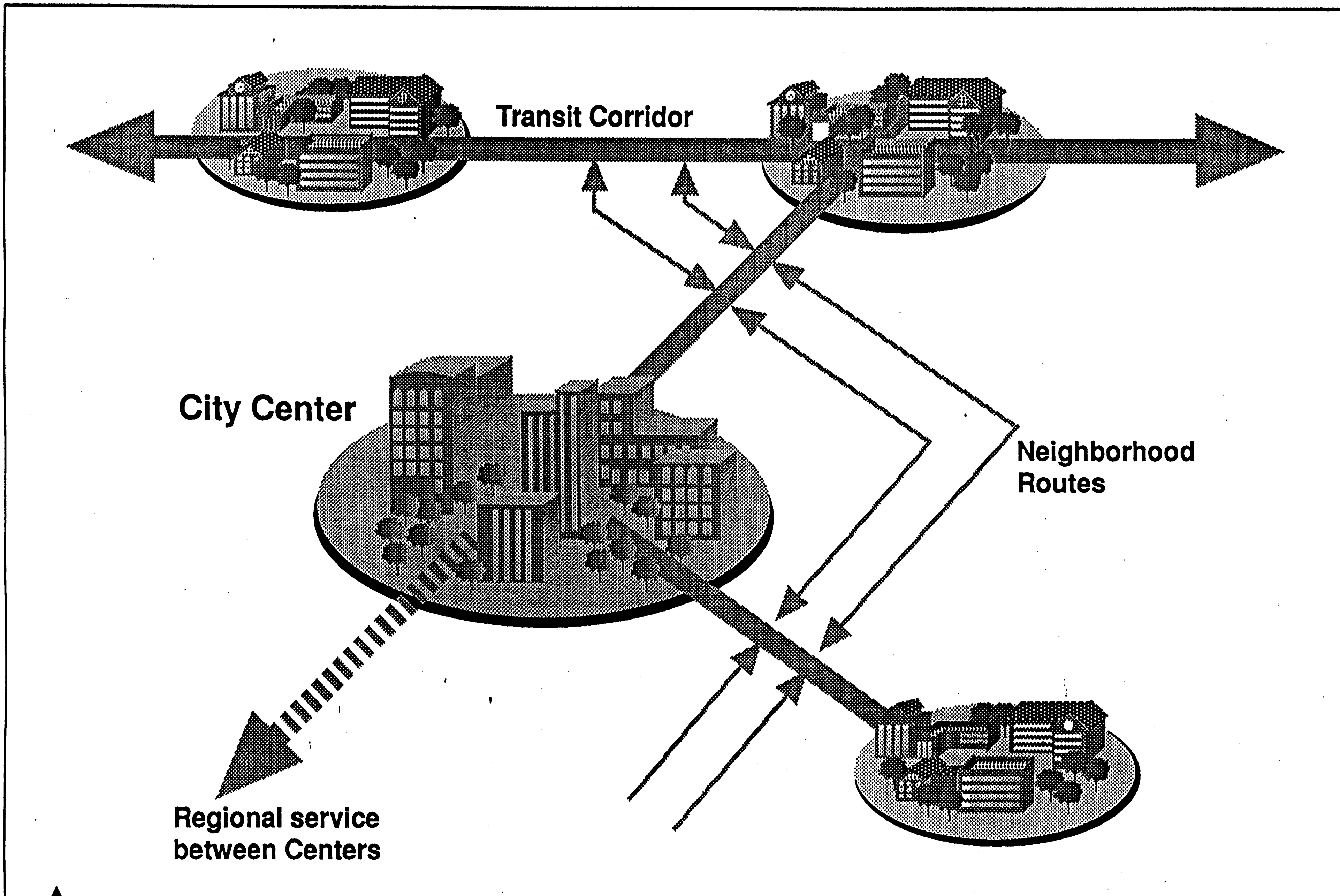
Vanpools and Shuttle Vans. The Commute Trip Reduction Act and the Americans with Disabilities Act, along with regional population and employment growth, require a significant increase in the fleet of smaller, more flexible vehicles, regardless of the selected alternative. The program includes about 3,140 vanpools and 680 shuttle vehicles by 2020.

Other Systemwide Elements. Improvements to computer systems, passenger shelters, traffic flow and safety, trolley overhead network, and the like are required to support the transit systems.

Local Capital Facility Improvements. At the community scale, capital improvements would encourage people to use transit and ridesharing in their communities. TSM improvements include by-pass lanes at congested intersections, increased distance between some bus stops; improved access to transit centers; better pedestrian access and waiting facilities; improved lighting; and adjustment of signals to give buses and HOVs priority. Along transit corridors, RTP would encourage partnerships linking pedestrian-oriented land use investments to transit capital and service improvements.

Technical Appendix B includes a summary of TSM capital improvements included within the build alternatives for the purposes of evaluation.

Transit Corridor Improvements. RTP proposes a partnership between transit, municipalities, local communities, and private investment to develop economically viable pedestrian-oriented linear corridors or activity clusters with a more intense mix of commercial, office, and multifamily development. Moderately scaled mixed use development, combined with pedestrian walkways, bicycle lanes, crosswalks, medians, pedestrian controlled signals, lighting, boulevard treatments, street trees, and the other transit preferential amenities identified above will help create an environment conducive to walking and transit access. Combined with intense transit service supported by proposed TSM investments (Figure 2.4), the program could nurture a shift from an automobile-oriented environment toward one emphasizing bicycles, pedestrians, and transit (Figure 2.5).



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Major Transit Streets Concept

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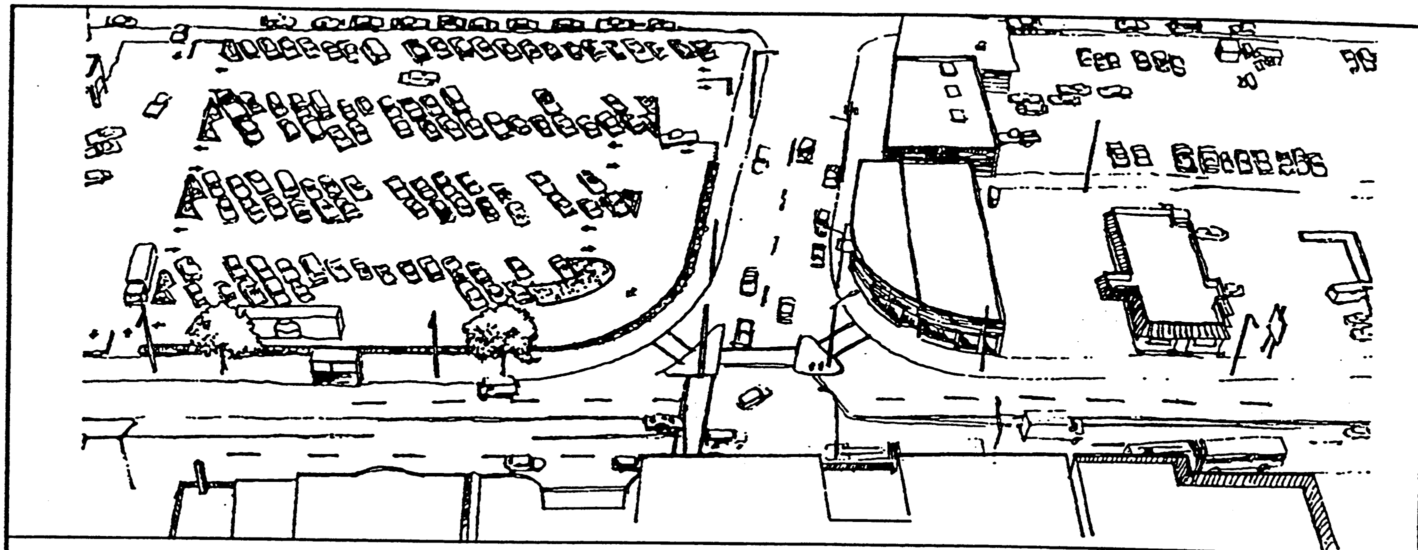
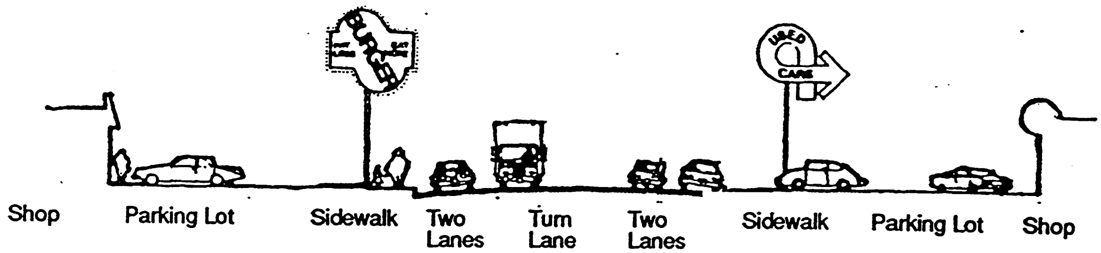
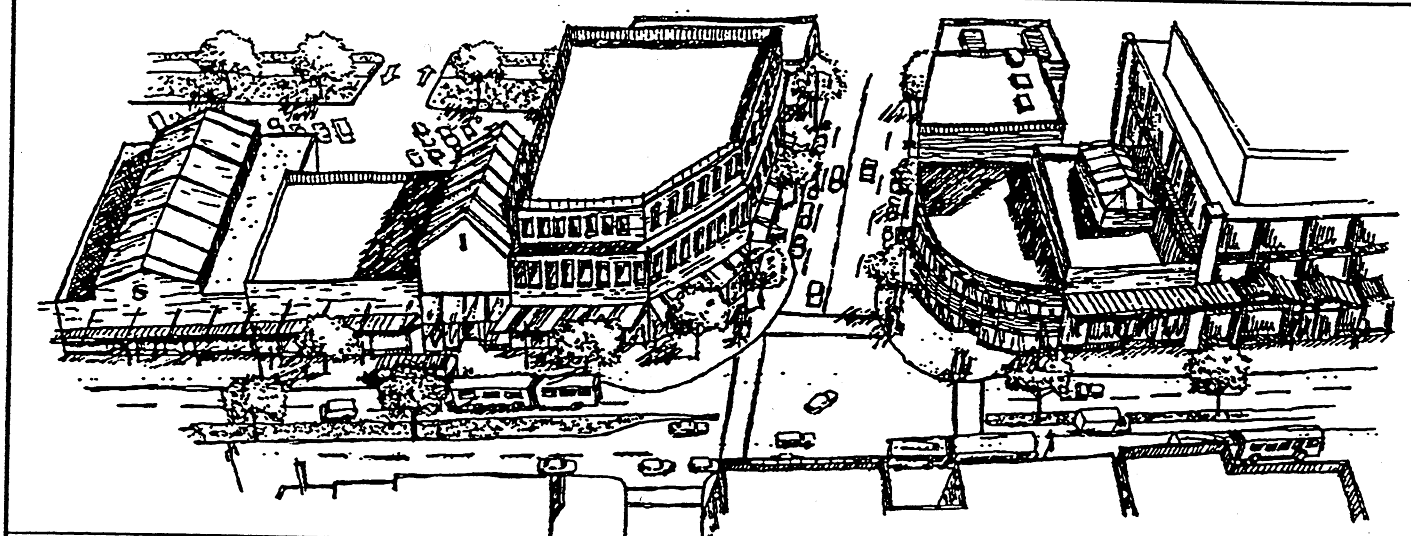
FIGURE 2.4



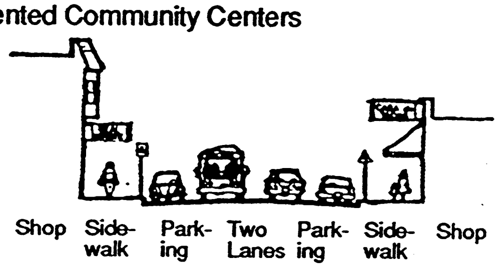
Before: Auto Oriented and Separate Single-Use Developments



Automobile Related Development



After: Mixed-Use Pedestrian Oriented Community Centers



Transit Related Development

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Example of Transit-Oriented Redevelopment

System Plan EIS

FIGURE 2.5

The partnerships will be key to developing and implementing locally responsive community plans. In addition to local service investments, RTP capital contributions may improve lighting, sidewalks, bicycle storage, stop access, and transit priority (queue by-pass, preferential signals, pedestrian bulbs, parking management). Trolley service will be extended to reduce bus emissions and noise.

2.2.1 TSM Alternative

2.2.1.1 TSM Alternative Concept

The TSM Alternative uses TSM measures, as described above, along with improved regional bus connections, to substantially increase transit service. By emphasizing lower-cost capital improvements and smaller-scale general traffic and HOV improvements, it provides a baseline against which the cost-effectiveness of major capital investments will be evaluated. While some of the projects in the TSM Alternative are included in transit agencies' adopted plans (see Section 1.8), they are in addition to the No-Build Alternative (see Section 2.1).

2.2.1.2 TSM Alternative Transit Service Plan

The regional transit network would link communities and regional centers (Figure 2.6) in both peak and off-peak directions and improve service across county boundaries, as recommended by Vision 2020. Other new routes would respond to expected population and employment growth. Regional service would be augmented by peak-period commuter express routes serving major centers. Regional service would connect major centers (Everett, University District, Bellevue, and Tacoma) and downtown Seattle, consistent with Vision 2020's centers concept. The following would guide the design of regional services:

- fast, frequent all-day limited-stop service
- linking centers, local transfer points, and the regional system
- a high level of commuter service to regional employment sites

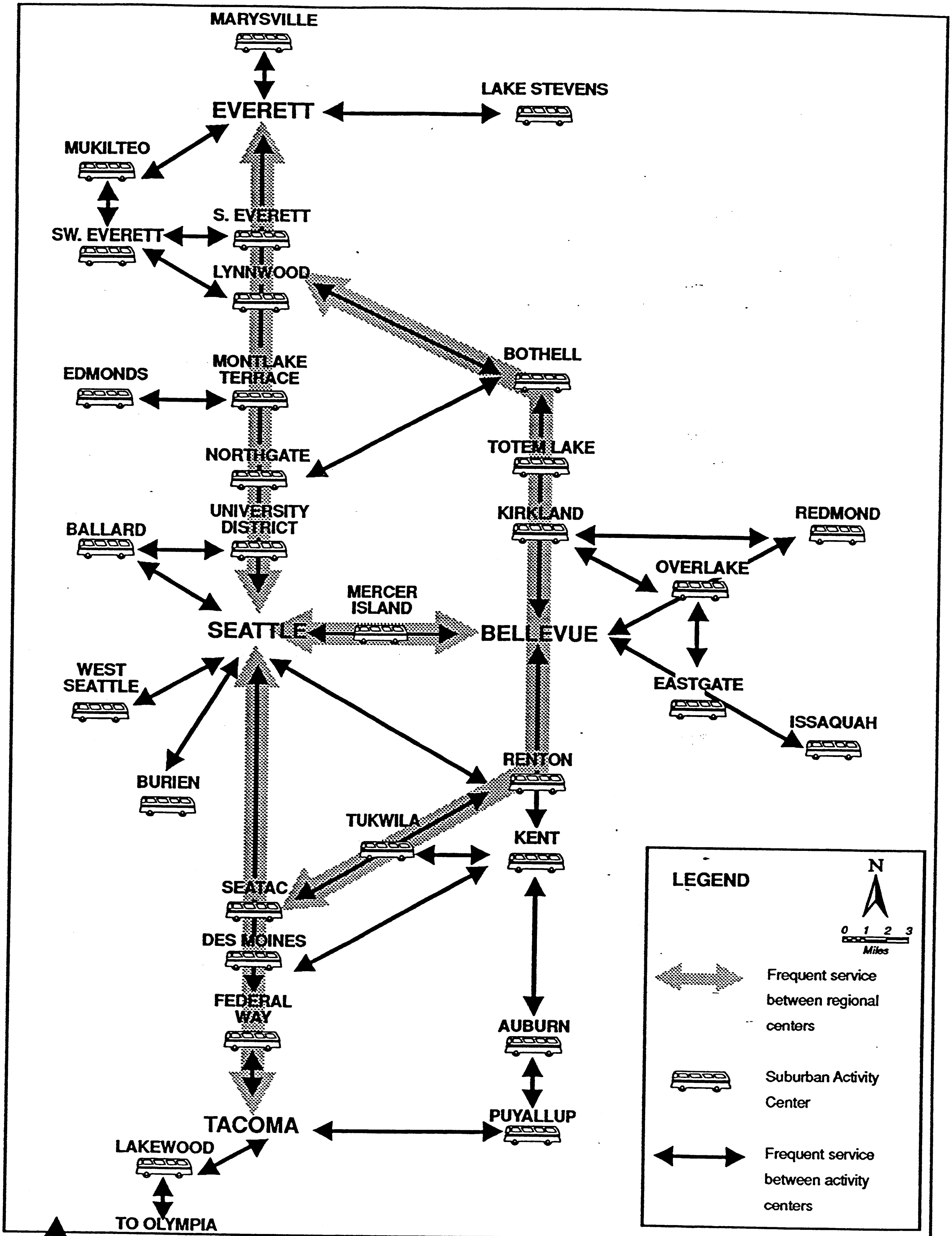
Subarea Applications: Service Orientation and Frequency

The following is an overview of how the TSM Alternative could be applied in each subarea in terms of service orientation and frequency.

Community Transit. Community Transit (CT) would double its total hours of transit service (Table 2.1). Regional service would operate every 30 minutes or less to downtown Seattle and 60 minutes or less to Seattle's north end during the service day. CT is also planning to enhance service to south Everett. Local service to Bothell and Aurora Village would run at least every 60 minutes.

TSM service improvements include:

- Providing service seven days a week
- Increased commuter service to South Everett employment sites
- Tripling peak-hour and doubling all day regional service
- Doubling local peak-hour service on key suburban routes



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Regional Transit Service Concept

System Plan EIS

FIGURE 2.6

- New routes in the southeast Snohomish County/Bothell area
- Increased evening and weekend service
- Innovative fixed-route paratransit service to low-density areas.

Everett Transit. Everett Transit would double its service, focusing on the growing inner-city commuter market (Table 2.1). Service improvements include:

- Doubling bus frequency on peak-hour service to downtown Everett
- Doubling bus frequency on selected midday service
- Improving commuter service to South Everett employment sites.

Metro. Metro would increase service hours by nearly 60 per cent (Table 2.1), improving local connections between centers and linkages to regional limited stop services operating on the freeway HOV system. All-day service frequencies would increase in the suburbs. All-day, frequent express services would connect major centers and local communities. Some express services may operate exclusively along freeways. connecting to transit centers and local routes. In areas such as the University District, local/express routes would be coordinated to serve centers and the freeway system. Peak period commuter routes would provide one-seat rides from neighborhoods and park-and-ride lots to major employment centers.

Service would include:

- Minimum 15 minute frequency during most of the day on primary routes within the dense urban areas of Seattle
- Minimum 30 minute frequency on secondary urban routes and primary suburban routes
- At least 60 minute frequency within or between major suburban areas
- Direct commuter routes with at least six one-way trips on each route
- Demand-responsive service in lower density suburban areas
- Customized bus services to major employment sites.

Pierce Transit. Pierce Transit would expand service to downtown Seattle, based on the level of demand identified by the modeling effort. Local community service and express services to downtown Tacoma would significantly improve.

Proposed TSM service improvements include:

- Tripling express service from Tacoma and Lakewood to downtown Seattle
- Doubling peak-hour service to employment and other transit centers
- Doubling service on key midday routes to outlying centers.

Additional Pierce Transit plans are described in Section 1.8.

2.2.1.3 TSM Alternative Capital Elements

In addition to the general TSM capital elements described above, the TSM Alternative would include the following:

Fleet. The regional bus fleet will be expanded by nearly 40 percent to support the service plan, reaching 2,632 vehicles (Table 2.3). Buses would use clean air technology such as natural gas fuels and electrical propulsion.

Included in the fleet expansion are more dual power (electric/diesel) coaches using the downtown Seattle transit tunnel.

Maintenance Bases. Four new bases would be needed to store and maintain the expanded fleet. Bases would include new fueling and storage facilities to accommodate the switch to alternative fuels.

Downtown Seattle Tunnel Modifications. Pre-staging facilities at the downtown Seattle transit tunnel would be required to handle the increased volume of buses.

Regional Capital Facility Improvements

At the regional scale, 384 lane miles would be added to complete the freeway HOV network. A freeway signal control/driver information system would improve traffic flow. Access improvements would give priority to transit and carpools. A major park-and-ride expansion would create nearly 14,000 stalls, most adjacent to the freeway system (Figure 2.7). In addition, 20 new freeway flyer stops would be built next to park-and-ride lots, allowing buses to remain in freeway rights-of-way. Arterial HOV lanes and priority on freeway ramps would give transit and carpools priority access to the freeway HOV system. The alternative also includes 26 miles of overhead trolley wire extensions on primary arterials. These improvements would significantly benefit transit and carpool speed and reliability.

Cost of Facilities

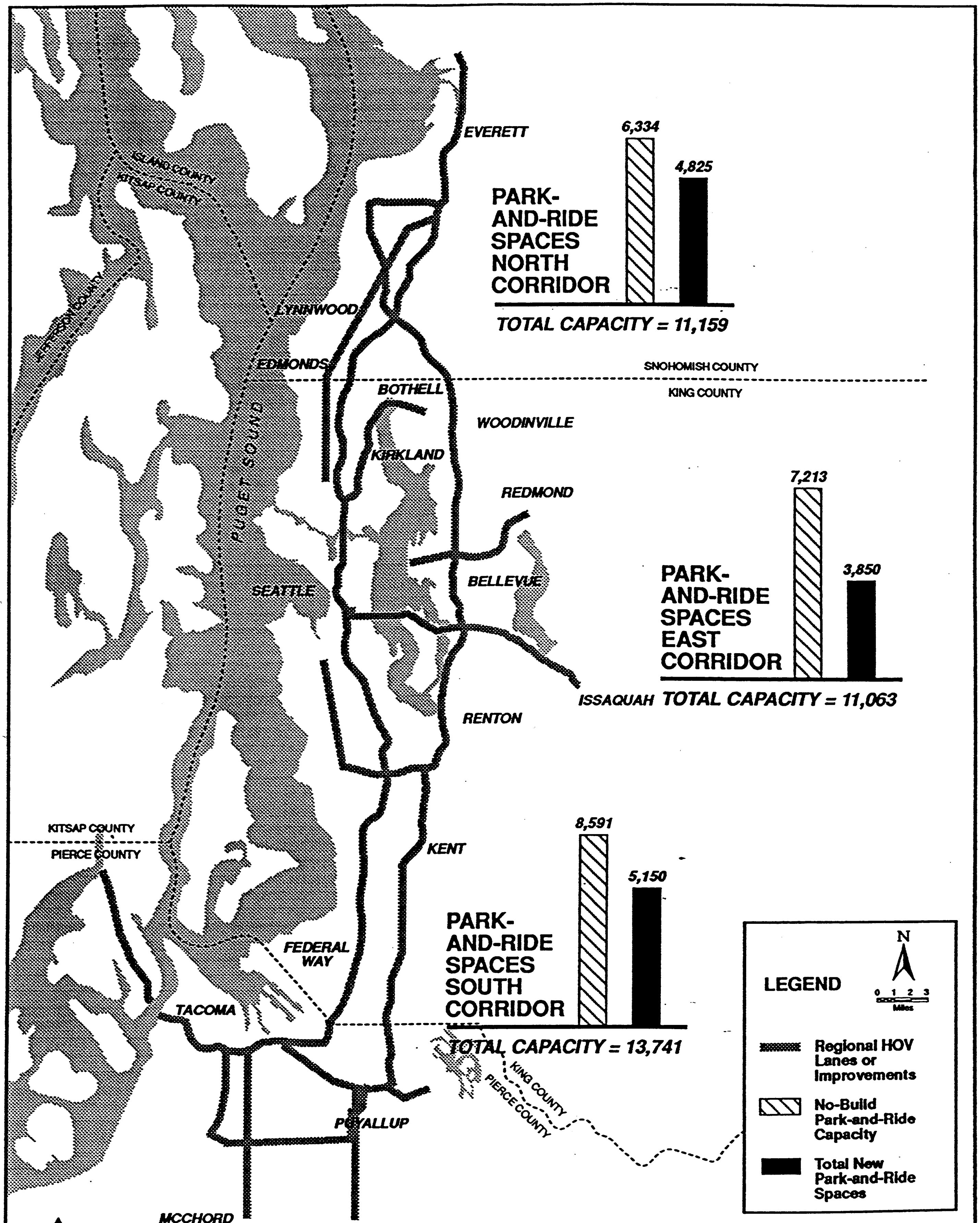
This alternative would cost $3.5 billion more than the No-Build Alternative.

2.2.2 Transitway/TSM Alternative

2.2.2.1 Transitway Concept

The Transitway/TSM Alternative adds exclusive guideways for buses and carpools to the basic TSM measures. In contrast to rail vehicles, buses can leave guideways and travel to off-line stations and through local neighborhoods, minimizing transfers between feeder service and the regional system. Buses can also skip intermediate stops between centers, share busway facilities with other HOVs, and use facilities designed for general-purpose traffic. The Transitway/TSM Alternative is intermediate in cost between the TSM and Rail/TSM Alternatives because of the smaller extent of the transitway and its use of already existing rights-of-way.

The Transitway/TSM Alternative builds on the HOV system, giving more speed and reliability where HOV lanes are inadequate. Facilities would include exclusive busways, barrier-separated transitways for buses and HOVs, freeway HOV lanes and direct access ramps, stations, and parking facilities (Figures 2.8 and 2.9). The alternative would improve transit access to centers such as the University District and Bellevue, would replace the reversible lanes on I-5 with a two-way transitway for buses, vanpools, and carpools, and would replace the reversible lanes on I-90 with a two-way busway. Use of the I-5 express lanes would provide high-speed, high-capacity service to Northgate and into Snohomish County.



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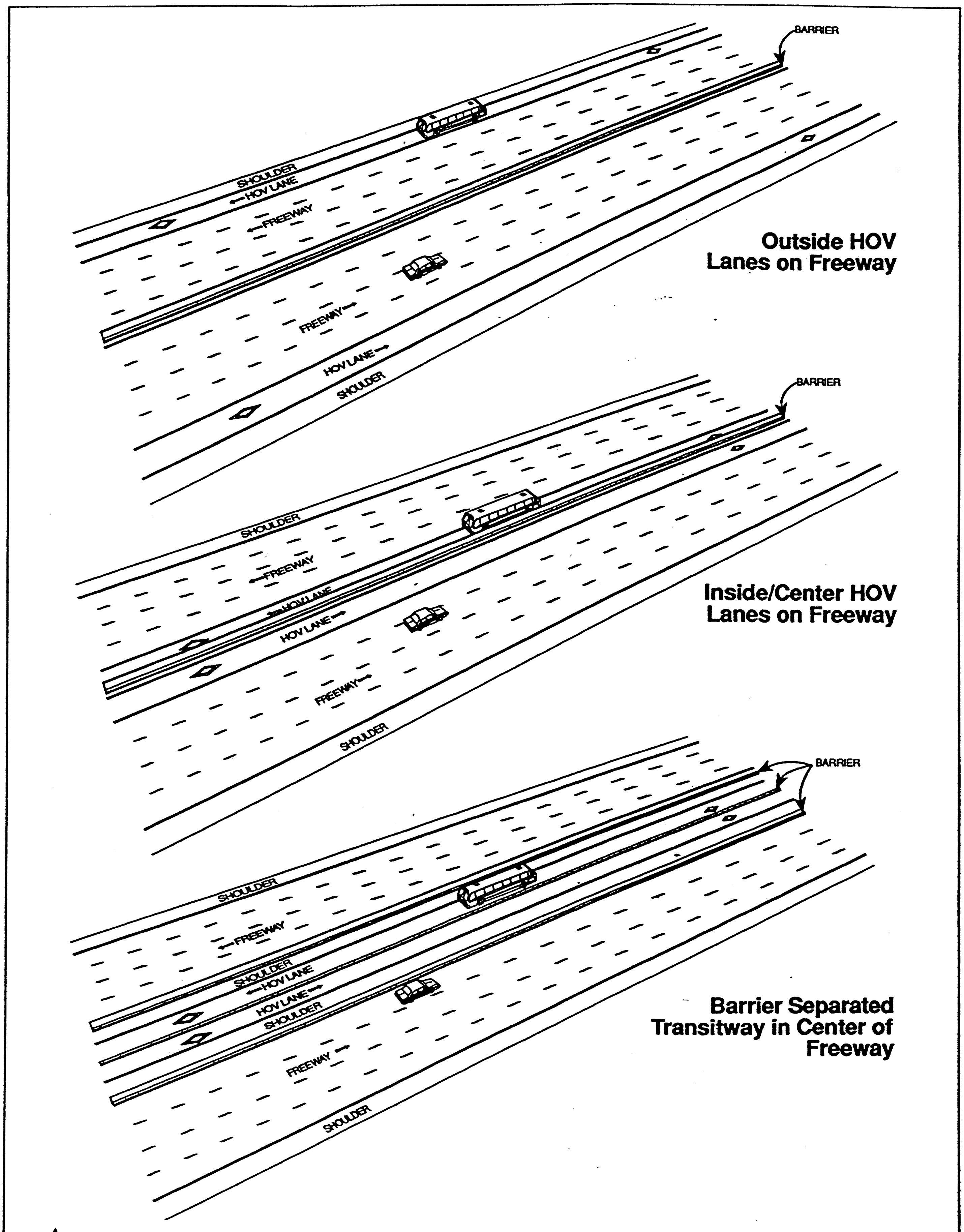
TSM Regional HOV System and Capital Improvements

System Plan EIS

FIGURE 2.7



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Typical Transitway & HOV Facilities

System Plan EIS

FIGURE 2.9

The Transitway/TSM Alternative takes advantage of the TSM Alternative's bus fleet, HOV system, and speed and reliability improvements. However, some TSM projects would not be included in the alternative due to duplication of function by the transitway and related improvements. Other TSM projects would be modified to complement the transitway system (see Technical Appendix B).

The following description portrays the Transitway/TSM Alternative in terms of the general areas served, the general service pattern, and the facilities required, which are part of the decisions to be made for the System Plan. *Although the description refers to specific rights-of-way and facility locations, this is for study purposes only. Other alternative alignments will continue to be considered. Detailed evaluation of specific alignments and facilities will occur during project-level environmental review if this alternative is adopted for the System Plan.*

2.2.2.2 Transitway Service Plan

Operating Concept

The Transitway/TSM Alternative would emphasize regional, local-express and express-only operations overlaid on neighborhood transit, paratransit, and ridesharing measures. *Express-only* routes would operate directly between park-and-ride facilities or transit centers to regional centers or between several centers. To take advantage of the transitway, some routes to downtown Seattle which currently cross Lake Washington on SR-520 would be rerouted onto I-90. The alternative would include two regional routes along I-5 and I-405, offering frequent all-day service. A trunk route would run every fifteen minutes between Everett and Tacoma by way of downtown Seattle. Another regional route would run every thirty minutes between south Everett and Bellevue.

Local-express service would combine collector and line-haul functions into one operation. Local-express routes would pick up and drop off passengers in neighborhoods and serve local park-and-ride lots or transit centers before connecting to other centers by way of the transitway network. Feeder bus service would also be provided to stations and park-and-ride lots. Feeder route passengers would transfer to express routes or the express portions of local/express routes.

Background transit service would consist of the TSM Alternative's baseline transit service modified to eliminate duplication and improve travel time and reliability. Some TSM baseline routes would be rerouted onto the transitway or truncated to provide feeder bus service.

Service Hours and Frequency

Transitway/TSM hours and frequency would be similar to the TSM Alternative. Increased transit speeds would increase platform miles somewhat over the TSM Alternative (see Table 2.1).

2.2.2.3 Transitway Capital Facilities

In addition to TSM capital elements, the Transitway/TSM Alternative would include the following:

Fleet. The regional bus fleet would be expanded by over 40 percent over the No-Build Alternative to support the service plan, reaching 2,654 vehicles (Table 2.3). Buses would use clean air technology such as natural gas fuels and electrical propulsion. Included in the fleet expansion are more dual power coaches using the downtown Seattle transit tunnel.

North Corridor

The North Corridor transitway for buses, vanpools, and carpools would extend to Northgate from the Downtown Seattle Transit Tunnel along I-5. The I-5 express lanes would become a two-way, barrier-separated transitway connecting with HOV lanes to the south and north. By 2020, HOV lanes would be extended to Marysville and connect to Paine Field/Southwest Everett along SR-525 and SR-526.

Ramp Access. Conversion of the I-5 reversible lanes to a two-way transitway would require new ramps and operational changes on existing ramps. New ramps would include a northbound transit tunnel from Convention Place Station, three new full access ramps in the University District, a new northbound offramp at Lake City Way, and full directional access ramps at Northgate. Northbound HOV access would be available from the existing Dearborn and Cherry/Columbia Street ramps and at Mercer Street. Southbound buses and HOVs could exit the transitway on existing ramps at Pine/Pike Streets, Stewart Street, and Mercer Street. The existing 42nd Street off-ramp would provide a northbound exit from the transitway. The existing Northeast 65th and Lake City Way ramps would provide southbound transitway access.

Other Access Improvements. Transit improvements would be provided in the University District. HOV signal and lane prioritization would be added on Northeast 45th Street and other streets with heavy transit usage.

Stations/Access Points. On-line (freeway) stations would be located at:

- Mountlake Terrace
- I-5/52nd Avenue West
- Lynnwood Park-and-Ride
- 164th Street SW
- 128th Street Southwest

Buses would exit the transitway to serve off-line stations such as Everett Mall, downtown Everett, and Marysville, as well as various locations in King County.

South Corridor

An exclusive busway would follow the E-3 busway and Union Pacific/Burlington Northern Railroad rights-of-way from downtown to center HOV lanes on I-5 near the I-5/State Route 599 interchange. As an alternative, the transitway could follow SR-99 and SR-599 to connect with I-5. Buses could continue on I-5 HOV lanes south to Tacoma and Lakewood. New connecting ramps would be needed between the I-5 HOV lanes at SR-599 and the transitway. TSM transit hubs would be off-line stations in this alternative.

Stations/Access Points. On-line stations would be located at:

- Royal Brougham Way

- South Spokane Street
- Boeing Access Road
- South 84th Street in Tacoma
- South 272nd Street.

An off-line station would be located at Kent-Des Moines Road. Transitway exit points would be located at Royal Brougham Way and South Holgate Street, and at Boeing Access Road. In addition to planned TSM access ramps (see Technical Appendix B), HOV lane access to Sea-Tac Airport would be provided at SR-599.

East Corridor

The East Corridor exclusive busway would extend from downtown Seattle east along the I-90 center lanes. Buses on the busway would then either enter shoulder HOV lanes on I-405 by means of new ramps or continue in center HOV lanes along I-90 to Issaquah. From the I-405 HOV lanes at SE 8th Street, buses would enter a three-mile long exclusive busway west of I-405 through downtown Bellevue. After recrossing I-405, the busway would follow Burlington Northern right-of-way to freeway HOV lanes on I-405 or SR-520 to continue north or east.

Stations/Access Points. The alternative would include on-line stations at:

- I-90 and Rainier Avenue
- Wilburton park-and-ride
- Bellevue Convention Center.

There would also be full bus access on I-90 to Mercer Island center and Mercer Island park-and-ride. Access to the I-405 HOV lanes north of Bellevue would be provided at Northeast 8th, Northeast 70th, Northeast 85th, Totem Lake, and Northeast 160th. Access on SR-520 could be provided at 130th Northeast, 148th Northeast, Northeast 36th, Northeast 51st, and State Route 901.

Cost of Facilities

This alternative would cost $4.3 billion more than the No-Build Alternative.

2.2.3 Rail/TSM Alternative

The Rail/TSM Alternative overlays an extensive rapid rail system and a commuter rail line onto most of the regional and local TSM improvements, including the completed freeway HOV system. Some TSM projects which provided access between freeways and centers or park-and-ride lots would be replaced by direct rail service. Significant expansion in park-and-ride capacity is also proposed, as compared to that for the TSM or Transitway/TSM Alternatives.

2.2.3.1 Technology

This alternative would be based on an rapid rail system on exclusive, grade-separated right-of-way. For purposes of evaluation, it is assumed that this system would operate with steel wheels on steel rails and would draw power from an overhead catenary. Maximum speeds would be 55 to 70 mph, with average speeds (including station stops) around 35 to 40 mph. The appropriate rail technology would be selected during project-level planning and environmental review (see Section 2.6.8). The alternative also includes

conventional commuter rail service on existing right-of-way between Tacoma and Seattle. Unless otherwise indicated, "rail" in this document refers to rapid rail and not to commuter rail.

2.2.3.2 Capital Facilities

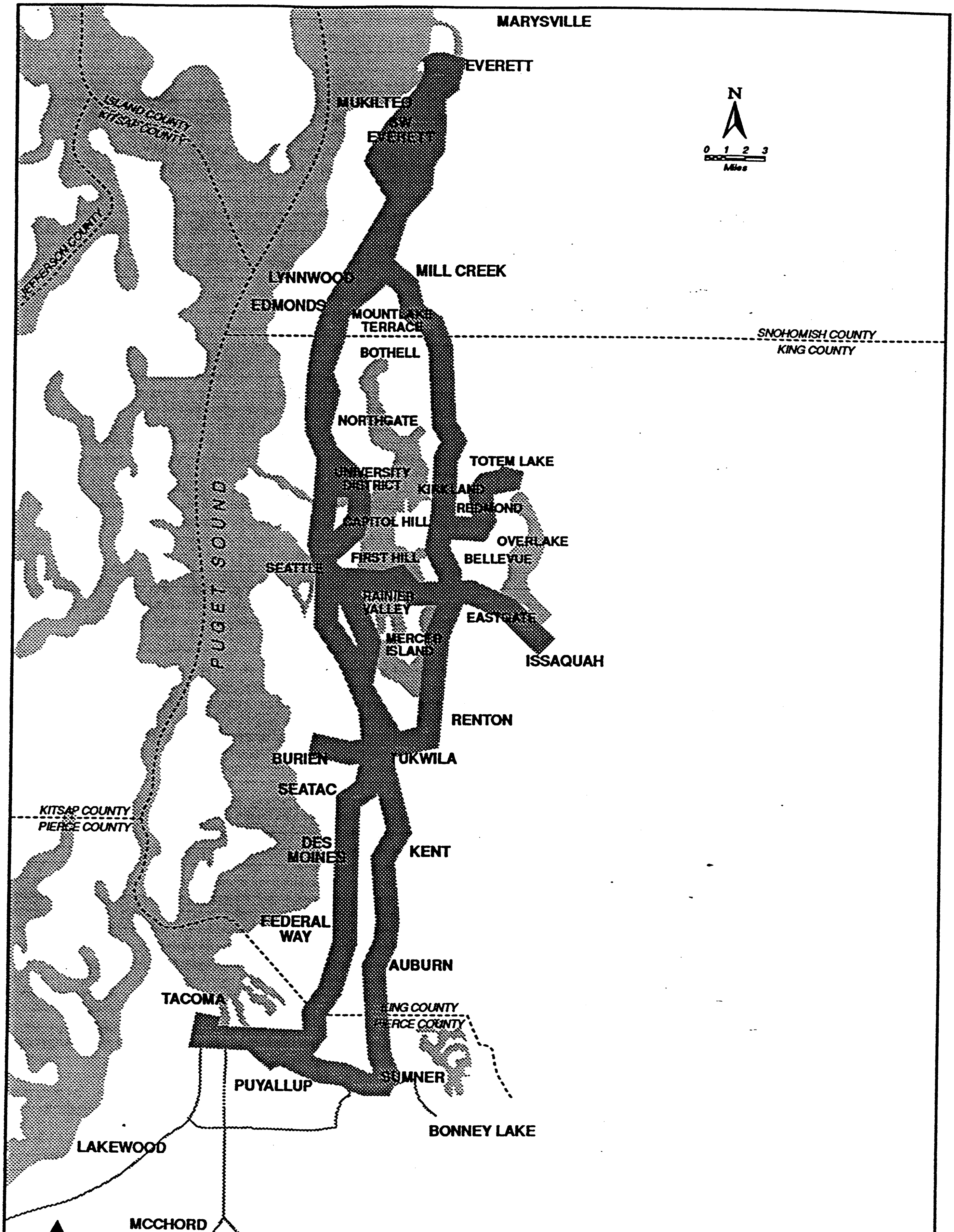
This description portrays the Rail/TSM Alternative in terms of general areas served, feeder bus pattern, and the support facilities, which are part of the decisions to be made for the System Plan. *Although the description refers to specific rights-of-way and facility locations, this is for study purposes only. Other alternative alignments and facility locations will continue to be considered. Detailed evaluation of specific alignments and facilities will occur during project-level environmental review if this alternative is adopted for the System Plan.* The configuration of the regional rail system is illustrated in Figure 2.10. For illustration purposes only, typical rail stations are shown in Figure 2.11. Baseline alignments and stations used for modeling are shown in Figure 2.12. Major alternative alignments considered for ridership modeling are described under the corridor descriptions below. Other potential variations and supplements to the baseline alignment are described in Sections 2.3 and 2.4. Rail facilities would be overlaid on a reduced set of TSM measures and an expanded park-and-ride capacity, based on the demand indicated by ridership modeling.

Alignment Characteristics. The major portion of the rail system would be on a *grade-separated* alignment, completely separated from motor vehicle, non-motorized, or rail traffic. Portions of the alignment would be in *tunnels*, constructed either by *boring* (tunneling underground) or by *cut-and-cover* techniques (excavating each tunnel from above and covering it with a lid). Portions of the alignment would be in *retained cuts* (below the surface but open to the sky). *At-grade*, or surface, portions of the grade-separated alignment would operate over or under any roadways they crossed. *Aerial* portions of the alignment would be on structure above the surface of the ground.

The entire commuter rail line and possibly some portions of the rapid rail line in Pierce and Snohomish counties would run on the surface with *at-grade* street crossings. Such crossings would require crossing barriers, warning signals, and special signalization.

Fleet. As shown in Table 2.3, the 2020 rail system would require almost 400 rail transit cars, as well as 30 conventional commuter rail cars and 11 locomotives for the commuter rail line. The regional bus fleet would be expanded almost 30 percent to support the service plan, reaching nearly 2,360 vehicles (Table 2.3). By 2020, dual-powered buses would be eliminated from the fleet, as buses would no longer use the downtown Seattle tunnel. Buses would use clean air technology such as natural gas fuels and electrical propulsion.

Stations. Approximately 78 stations are proposed for the rail system. Potential station locations in each corridor are described below. To allow the speeds necessary in a regional system, most stations would be 1.5 to 2 miles apart, although they would be closer in high transit volume areas. Commuter rail stations would be spaced about 5 miles apart. Final locations and design of stations would be determined during detailed planning, including community involvement and environmental review, to assure community



Regional Transit Project

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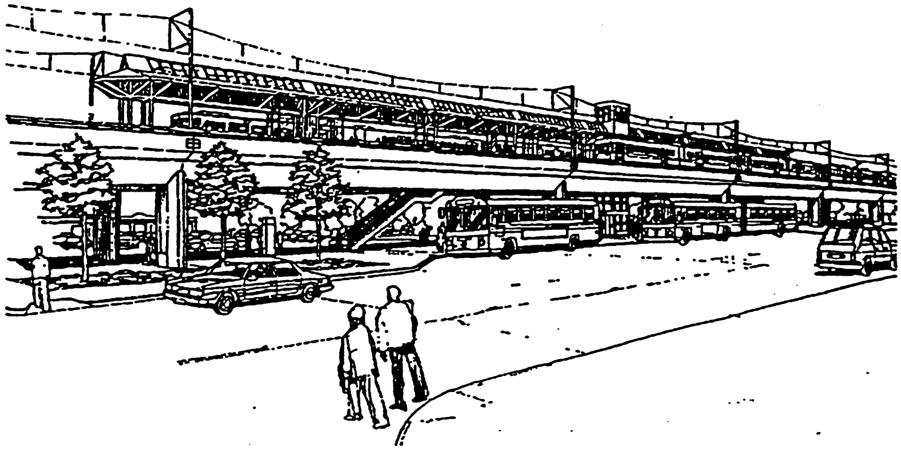
RTPF0204A

2020 Rail Corridors (Communities/Markets Served)

System Plan EIS

FIGURE 2.10



Aerial, Center Platform

At-Grade Side Platform

Subway Center Platform

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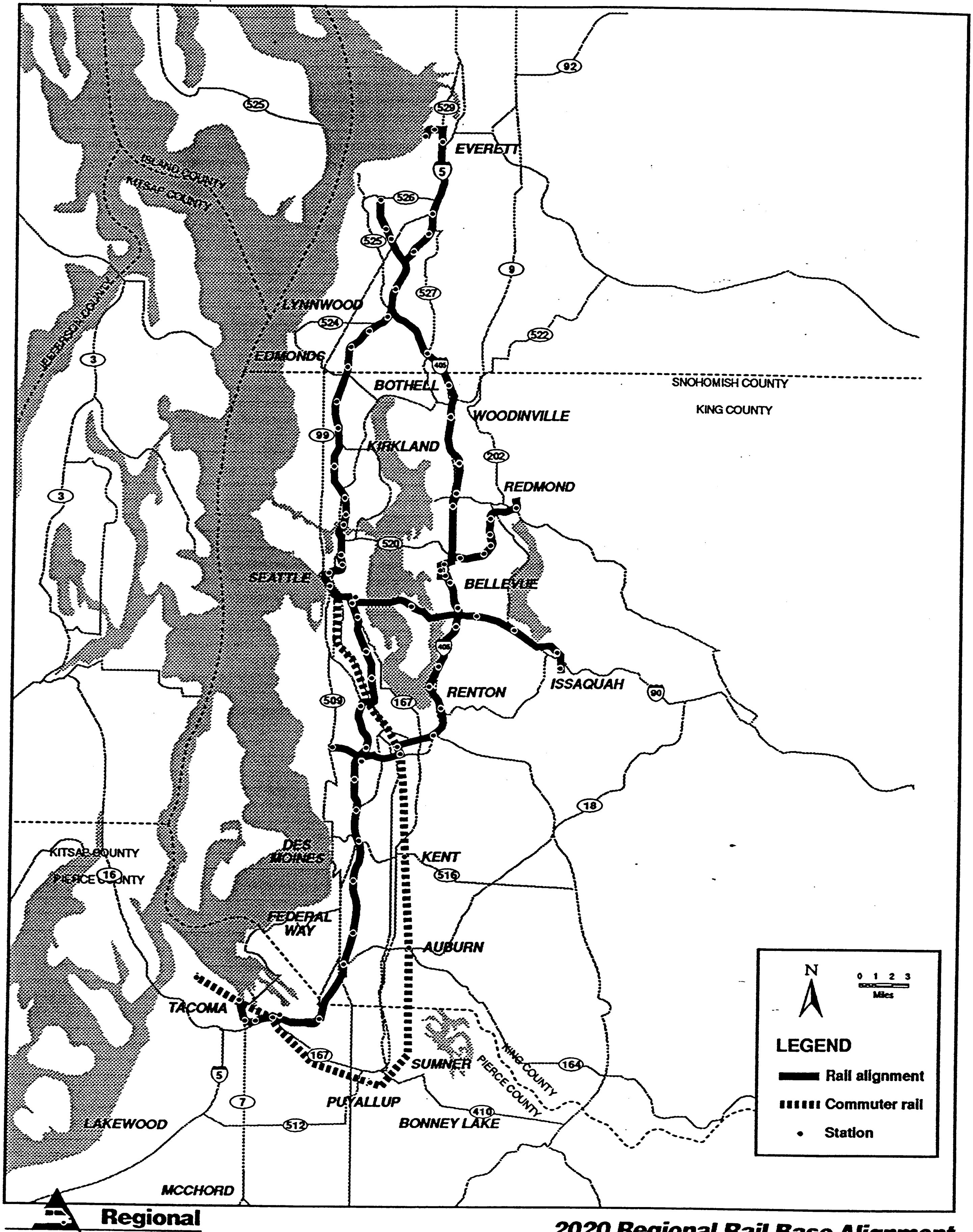
RTPG0269G

Typical Rail Stations

System Plan EIS

FIGURE 2.11

Source: Arai/Jackson Architects & Planners, 1991



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RTPG0269B

2020 Regional Rail Base Alignment

System Plan EIS

FIGURE 2.12

compatibility and appropriate levels of walk, bicycle, bus, and automobile access.

Rail Maintenance Facilities. The rail system would need a major maintenance and storage facility of about 50 acres in the South Corridor and smaller maintenance and storage facilities in the other corridors.

North Corridor

Alignment Description. The North Corridor alignment would extend from the Downtown Seattle Transit Tunnel to the University District, Northgate, Lynnwood, and Everett.

Two alignment options have been studied between downtown Seattle and Northgate:

- o The alignment recommended by the JRPC serves First Hill, Capitol Hill, the University District, and the Roosevelt neighborhood by way of a tunnel extending under Capitol Hill, Portage Bay and the University District to the general vicinity of Northeast 70th Street, and continues northward to Northgate along the I-5 corridor.

- o The second alignment follows the I-5 corridor to Northgate, providing service to south Lake Union instead of Capitol Hill. The I-5 alignment would include a people mover to link service to the University of Washington campus.

Three general alignment variations are being studied between Northgate and Lynnwood:

- o The first continues north along the I-5 corridor to Lynnwood.

- o The second diverts from the I-5 corridor north of Northgate, connects to SR-99 (Aurora Avenue North) somewhere between Northeast 125th Street and Northeast 155th Street and continues north along SR-99 to the vicinity of 220th Street in Snohomish County, where it would leave SR-99 and rejoin the I-5 alignment south of the Lynnwood park-and-ride.

- o The third is similar to the second between Northgate and 220th Street, but continues north along SR-99, connecting to a local surface rail alignment being considered within Snohomish County. This alignment would reach Everett along the SR-99/Evergreen Way corridor, bypassing Alderwood Mall in Lynnwood.

Three principal alignment options are being examined which would extend regional rail service from Lynnwood to Everett:

- o The first continues north along the I-5 corridor from Lynnwood, follows Broadway within Everett to a bus and automobile intercept station near I-5 east of downtown Everett, and proceeds at-grade into downtown Everett. The Southwest Everett area would be served with a spur from I-5 to SR-526 along Airport Road.

- o The second diverts from the I-5 corridor near Airport Road to the Southwest Everett area, proceeds east in the SR-526 corridor to SR-99/Evergreen Way, then north along Evergreen Way to downtown

Everett, and then connects to a bus and automobile intercept station near I-5 and SR-2.

- o The third option diverts from the I-5 corridor near Alderwood Mall, rejoining SR-99 near SR-525, proceeds north along SR-99, diverts to the Southwest Everett area along Airport Road, proceeds east in the SR-526 corridor to SR-99/Evergreen Way, and then north along Evergreen Way to downtown Everett.

Other regional rail alignments may be considered involving variations or elements of any of the aforementioned alignments.

Both surface alignments and a subway alignment are being considered for service within downtown Everett. Due to the need to maintain adequate traffic operations within downtown Everett, a change in service characteristics would probably be required between the surface alignment and the trunk line portion of the alignment. Options include turning back some trains or reducing train length at a station south of Everett or operating a shuttle rail segment from downtown Everett with cross-platform transfers at a trunk line station south of downtown.

Three local surface rail alignments are also being considered from downtown Everett south into Snohomish County. These extensions of local surface rail would orient rail service toward local and intracounty transit needs and alter the access pattern and feeder bus service to the trunk line terminal station. The principal local surface rail alignments under consideration would extend south from downtown Everett along the Evergreen/SR-99 corridor. They include:

- o extending to the vicinity of Everett Mall
- o extending to SR-526, then west to provide service to Paine Field and Southwest Everett
- o bypassing Paine Field and Southwest Everett and following SR-99 to the vicinity of the King/Snohomish county line to connect to the trunk line alignment at a transfer station.

Section 2.3 provides a more detailed description of the local surface rail concept and a summary of the evaluation to date of possible alignments.

Transit service within the north corridor could also be supplemented with express passenger ferry service or commuter rail service between Seattle and Everett (see Section 2.4).

Stations/Access Points. Stations would provide access from employment centers, neighborhoods, park-and-ride lots, and other transit lines.

Potential station locations between downtown Seattle (Convention Place Station) and Northgate include:

Capitol Hill alignment:	I-5 alignment:
First Hill (Madison Street)	Mercer St/S. Lake Union
Capitol Hill (1 or 2 Broadway stations)	NE 45th St (connected to UW with a people mover)
University District (2 stations on 15th NE)	

Northeast 65th Street	Northeast 65th St
Northgate	Northgate

Potential station locations between Northgate and the Lynnwood park-and-ride lot include:

I-5 Alignment	Aurora/SR-99 Alignment:
Northeast 145th Street	North 130th Street
Northeast 175th Street	North 145th Street
220th St. SW (Mountlake Terrace)	North 155th Street
236th St. SW (Mountlake Terrace	North 175th Street
	North 192nd Street
	Aurora Village
	220th Street Southwest

Other potential stations within Snohomish County include:

I-5 alignment:	SR-99/Evergreen Way alignment (stations only under consideration for local surface rail options are indicated with *):
Lynnwood park-and-ride	228th St SW *
Lynnwood center/Alderwood Mall	Edmonds park-and-ride *
164th St SW	Lynnwood *
128th St SW (S. Everett)	180th St SW *
Everett Mall	Keelers Corner *
Broadway/35th St SE	148th St SW *
	SR-525 *
	North Manor Way *
	Airport Road
	112th St SW *
	100th St SW *
	Casino Road *
	Campus Parkway *
	Madison Street
	52nd St SW * -
	41st St SW
	35th St SW *

Southwest Everett link station locations:

- SR-99/Airport Road
- Beverly Park Road
- Paine Field/Southwest Everett
- Casino Road and 10th Avenue (local surface rail)
- SR 526

Downtown Everett and vicinity station locations:

- Everett park-and-ride
- Smith Avenue (downtown surface alignment)
- downtown Everett
- Everett Waterfront

Stations south of Northgate and in downtown Everett would be reached primarily by walking, bicycling, or feeder bus, as would local surface rail stations. Regional rail stations between the Northgate station and downtown Everett would incorporate moderate to substantial park-and-ride capacity, for up to 11,500 new park-and-ride spaces within the north corridor.

Maintenance Facilities. Permanent maintenance and storage facilities would probably include a central facility in the industrial area south of Seattle and a smaller vehicle maintenance and storage facility somewhere in north King or Snohomish county.

South Corridor

Alignment Description. One alignment would extend from downtown Seattle through Federal Way to Tacoma. A connecting east-west segment would extend from Burien east around the south end of Lake Washington to connect with the East Corridor. A commuter rail line would extend from downtown Seattle to Tacoma through the Green River Valley.

Two alignment options, one serving the Duwamish industrial area and the other Rainier Valley, are being studied between downtown Seattle and south Boeing Field. The two options rejoin near Boeing Access Road. The alignment continues south along SR-99 or Interurban Avenue South (serving Southcenter) to SR-518 and then directly serves Sea-Tac Airport. The alignment continues through the City of SeaTac and follows the proposed SR-509 extension to connect with I-5 near South 216th Street. It then follows the I-5/SR-99 corridor south to Tacoma. The alignment could potentially be extended south to serve the Lakewood market. See section 2.4.2.4 for a more detailed discussion.

Duwamish Industrial Alignment. This alignment follows the E-3 busway south from downtown Seattle past South Spokane Street. It crosses the rail yards to follow Fourth Avenue South to East Marginal Way South. It continues along East Marginal Way South to Boeing Access Road, where it crosses the Duwamish River and connects to SR-99.

Rainier Valley Alignments. The Rainier Valley alignments follow I-90/Dearborn to Rainier Avenue South, then Rainier Avenue South or Martin Luther King, Jr. Way to South Henderson Street, then Henderson west to the south end of Boeing Field. The alignment recommended by the JRPC is the Rainier/Martin Luther King alignment.

Stations/Access Points. Stations would provide access from employment centers, neighborhoods, park-and-ride lots, and other transit lines. Potential locations along the Duwamish industrial alignment include:

- Royal Brougham Way
- South Spokane Street
- South Michigan Street
- 16th Avenue South
- South end of Boeing Field.

Potential locations in Rainier Valley include:

- Vicinity of I-90
- South McClellan Street
- South Genesee Street

- South Graham Street
- South Henderson Street.

Other potential station locations include:

- Boeing Access Road and East Marginal Way South
- Southcenter
- SR-99/SR-518 interchange
- Sea-Tac Airport
- SeaTac Town Center
- Kent-Des Moines Road
- Star Lake
- Federal Way
- South Federal Way
- SR-167/I-5 (Fife)
- Vicinity of the Tacoma Dome
- Downtown Tacoma.

Potential stations along the east-west alignment include:

- Burien
- SR-99
- Southcenter
- Boeing Longacres site
- South Renton
- Renton Boeing plant
- Kennydale.

Stations north of Boeing Access Road and in SeaTac and downtown Tacoma would be reached primarily by bicycling, walking, or transit feeder service. The station at the SR-99/SR-518 interchange would be primarily a transfer station between rail lines. Other stations would probably include a significant park-and-ride component. About 10,000 new park-and-ride spaces would be built along the corridor.

Maintenance Facilities could be near Kent-Des Moines Road or Boeing Access Road and near SR-518/SR-99.

Commuter Rail Element. Commuter rail (see Figure 2.12) consists of conventional rail cars pulled by a locomotive, operating with greater frequency in the direction of commuter travel. The service would run through the Green River Valley from Tacoma to downtown Seattle along Burlington Northern or Union Pacific Railroad tracks by 1997. The commuter rail line could connect with the rapid rail system at Tacoma, Longacres, Boeing Access Road, and downtown Seattle. A commuter rail spur line could also run from Black River Junction to north Renton as an interim service until the rapid rail link is completed between Renton and the Seattle-Tacoma rapid rail line (see Section 2.4.2 for more details).

Potential Tacoma-Seattle commuter rail stations include:

- Downtown Seattle
- Spokane Street
- Georgetown
- Boeing Access Road (Oxbow)
- Longacres

- o Downtown Kent
- o North Auburn
- o Downtown Auburn
- o South Auburn
- o Puyallup
- o Sumner
- o Tacoma Dome
- o Tacoma CBD.

Except for downtown Seattle, Spokane Street, and Tacoma, these stations would likely need a significant park-and-ride component to serve transit riders not able to effectively use feeder bus service. Additional local stops with limited service designed for transit and nonmotorized access may be proposed during project-level review. Commuter rail maintenance facilities could be in Auburn or Tacoma.

East Corridor

Alignment Description. The East Corridor alignment would link the Downtown Seattle Transit Tunnel to downtown Bellevue following I-90 to I-405, Richards Road, or possibly Bellevue Way. From downtown Bellevue the line would branch northeast to Redmond and north along I-405 to Alderwood Mall. Other segments would follow I-90 to Issaquah and Burlington Northern tracks to Renton.

Station/Access Points. Station locations being studied include:

- o I-90 at Rainier Avenue South
- o Mercer Island
- o I-90/I-405 or Factoria
- o South Bellevue park-and-ride or Wilburton park-and-ride lot
- o Downtown Bellevue
- o locations along I-405 including Houghton, Northeast 85th, Totem Lake, Northeast 160th, east Bothell, and Canyon Park
- o Locations between Bellevue and Redmond, including Northup/124th NE, Overlake, Evergreen Highlands, Northeast 51st/SR-520, downtown Redmond, and southeast Redmond.

Additional stations could be located at Eastgate park-and-ride lot and Issaquah. Stations could be located south of Bellevue at Newport Hills and near May Creek.

Stations in Seattle, downtown Bellevue, Overlake, downtown Redmond, and downtown Issaquah would be reached primarily by walking, bicycling, or bus feeder service. Other stations would probably include a significant park-and-ride component. About 13,000 new park-and-ride spaces would be added along the corridor.

Maintenance Facilities. Interim facilities could be located near Metro's current Bellevue base. Permanent facilities would be in southeast Redmond.

Cost of Rail/TSM Facilities

This alternative would cost $10.3 billion more than the No-Build Alternative.

2.2.3.3 Rapid Rail Service Plan

The service plan is an example of how the rail and bus system could operate. The plan is preliminary and subject to change.

Operating Concept

Rapid rail service could operate along five through routes (Table 2.5). Transfer points would be at Lynnwood, downtown Seattle, downtown Bellevue, I-405/I-90, SR-99 or Interurban/SR-518, and I-90/Rainier (if a Rainier Valley alignment is selected; see the South Corridor discussion in Section 2.2.3.2). The rapid rail system would rely on TSM-based feeder bus routes, transit centers, and park-and-ride lots linked with rail stations.

Table 2.5. Conceptual Rail Routes.

Line	Service Area Description
Line 1	Everett to Seattle, then east to Issaquah.
Line 2	Everett to Seattle, then east to Bellevue and Redmond.
Line 3	Northgate to downtown Seattle, continuing south to Tacoma.
Line 4	Paine Field through Bothell, Bellevue, and Renton to Burien.
Line 5	Northgate to Seattle, continuing south to Federal Way.
Commuter Rail	Seattle to Tacoma through the Green River Valley.

Service Hours and Frequency

The system would operate 20 hours a day. By 2020, frequencies would range from every two to twenty minutes (Table 2.6).

Table 2.6. Peak Hour Frequencies of Rail Operations (2020).

Segment	Line(s)	Peak Frequency	Base Frequency	Owl Frequency
Everett to Northgate	1,2	5 minutes	8 minutes	10 minutes
Northgate to Seattle CBD	1,2,3,5	2 minutes	3 minutes	7 minutes
Seattle CBD to Federal Way	3,5	3 minutes	4 minutes	10 minutes
Federal Way to Tacoma	3	10 minutes	15 minutes	20 minutes
Seattle CBD to I-405/I-90	1,2	5 minutes	8 minutes	10 minutes
Bellevue CBD to I-405/I-90	2,4	6 minutes	9 minutes	10 minutes
Bellevue CBD to Redmond	2	12 minutes	18 minutes	20 minutes
Issaquah to I-405/I-90	1	12 minutes	18 minutes	20 minutes
Paine Field to Bellevue CBD	4	15 minutes	20 minutes	20 minutes
Burien CBD to I-405/I-90	4	15 minutes	20 minutes	20 minutes
Seattle to Tacoma	Commuter Rail	15 minutes	-	-

Bus Service

The background Rail/TSM bus system would consist of feeder buses and local buses. The feeder bus network would serve rail stations. The network

of local and express bus routes that do not specifically serve stations would provide supplemental community and regional service.

TSM routes near rail stations would probably be rerouted to serve the stations. TSM routes which were redundant with rail service would be truncated or deleted entirely. New routes would be proposed, as appropriate, to serve rail stations from areas unserved by modifications to the TSM bus network.

North Corridor. All stations would be served by one or more feeder routes. The University District and Northgate stations would have the greatest number of feeder buses. In addition to North Corridor routes, the University District stations would be served from the East and South corridors. In Everett new local circulator routes would provide access to rail stations from areas not served by the TSM network.

The local bus system would still link areas west of I-5 to downtown Seattle. Metro would also provide local service between First Hill and North Seattle and paratransit services to Kenmore and Bothell. Community Transit would continue to link local Snohomish County communities, as well as Aurora Village. Everett Transit would continue to provide Everett local service and express service between Mukilteo and Everett Boeing,

South Corridor. Feeder routes would link stations with south King County communities, Rainier Valley, West Seattle, and south Seattle. Pierce Transit would link the rail system to the rest of Pierce County. Metro would link Burien, West Seattle, Southcenter, and Renton to stations along the Burien-Renton alignment. Pierce Transit would provide new routes connecting Bonney Lake, Lakewood, Olympia, and Fort Lewis to rail stations.

Metro would still provide express service between downtown Seattle and White Center, Harbor Island, Beacon Hill, and Vashon Island. Metro and Pierce Transit would continue to provide local service in the South Corridor.

East Corridor. Feeder bus service would operate to all rail stations in the East Corridor. A new route would link Totem Lake and Kirkland to the University District, stopping at stations at Totem Lake, NE 85th, and NE 70th. Express buses would still link Snohomish County to Redmond.

Local regular bus service would still be provided, as well as express bus service to downtown Seattle from Kirkland.

2.2.4 The JRPC Recommendation

On September 18, 1992, the Joint Regional Policy Committee (see Section 1.1) adopted Resolution No. 4. This resolution recommends for public review and comment a draft System Plan that could be implemented in the region by the year 2015. A summary of the JRPC's recommendation follows; a more detailed version is contained in the *Draft Regional Transit System Plan*.

The draft System Plan recommended by the JRPC will be revised, based on comments received during the review period for the DEIS. JRPC adoption of a final System Plan is scheduled for spring of 1993, after the issuance of this Final Environmental Impact Statement.

This FEIS covers a wide range of alternatives to ensure that the range of impacts and potential mitigation measures covers the range of alternatives, impacts, and mitigation measures of the plan that may ultimately be adopted by the JRPC. More scaled-back options, such as recommended by the JRPC in the recommended draft System Plan, are possible. Given the broad scope of this EIS, the final System Plan adopted by the JRPC will likely fall within the range of alternatives and impacts considered herein. If it should fall outside these ranges, additional system-level environmental analysis may be required under the State Environmental Policy Act (SEPA).

It should be noted that the JRPC's recommendation is *not* a "preferred alternative" designation as described in SEPA or Metro's SEPA Rules. The designation of a preferred alternative will occur only after the public review process is complete and the Final EIS is issued. It should be further noted that, under both SEPA and the National Environmental Policy Act (NEPA), the final selection of modes and alignments can be made only after project-level environmental analysis is complete.

2.2.4.1 Comparison of Rail/TSM Alternative and the Draft System Plan Recommended by the JRPC

The draft System Plan recommended by the JRPC is a variation of the Rail/TSM Alternative covered in detail in this FEIS (Table 2.7). Generally speaking, the impacts of the Rail/TSM Alternative (described in Chapter 3 of this FEIS) will be similar to those of the JRPC recommendation. However, the geographic extent of impacts of the JRPC's draft System Plan is somewhat less. The discussion of the affected environment and the list of potential mitigation measures is identical between the two, but the extent of where mitigation measures are necessary will be somewhat less under the JRPC's draft System Plan.

Table 2.7. Comparison of Rail/TSM Alternative with JRPC's Draft System Plan.

	Rail/TSM Alternative	JRPC Recommendation
TSM Improvements	$826 million investment	$1.2 billion investment
Bus Service	See Section 2.2.3.3	Same as Rail/TSM, except additional express bus service on I-405 and I-90 to serve Bothell, Renton, and Issaquah
Rail Stations		
North Corridor	Up to 21	Same as Rail/TSM
South Corridor	Up to 22	Up to 16 in initial phase
East Corridor	Up to 22	Up to 15 in initial phase
Rail Miles	124 miles	84 miles
Markets Served by Rail	See Section 2.2.3.2	Same as Rail/TSM except Bothell, Issaquah, Renton. These could receive extensions of the rail system after 2015.
Commuter Rail	40 miles Up to 10 stations	44 miles, including spur to Renton Boeing Up to 12 stations

The draft System Plan recommended by the JRPC for the rail component focuses on the time frame through 2015, whereas the remainder of the draft System Plan focuses on a time frame through 2020. The JRPC has not precluded future extensions of the rail system that could include those

segments of the Rail/TSM Alternative not contained in its recommended draft System Plan. These segments include: Lynnwood to Totem Lake via Bothell, South Bellevue to Issaquah, and South Bellevue to Burien via Renton. A commuter rail extension to serve downtown Renton and North Renton-Boeing has been added. Decisions concerning future extensions will be made by the appropriate policy body at some future date.

2.2.4.2 Phasing of the JRPC Recommended Rail Plan

The final system plan, to be adopted by the JRPC in early 1993, will identify the initial markets that rail would serve by 2005. One of three general approaches will be followed in making this initial phasing decision:

- Option A. Construct as much of the central portion of the system by 2005 as possible.
- Option B. Construct as much of one corridor by 2005 as possible, while delaying implementation in the other corridors.
- Option C. Construct operable portions of the system in each of the three counties by 2005.

The impacts discussion in Chapter 3 of this FEIS covers general construction impacts of building a rail system. The type of impacts will not vary among the phasing alternatives; the geographic extent of the impacts at any moment in time and the duration of impacts will vary among the phasing alternatives.

Under Option A, the initial impacts will center on the neighborhoods immediately adjacent to downtown Seattle and will gradually move out in three directions. As construction proceeds, construction impacts will move out to widely separated areas within King County and then to Snohomish and Pierce Counties.

Under Option B, impacts will focus on several neighborhoods adjacent to downtown Seattle during an intense, but relatively short construction period. Impacts will remain concentrated in communities on the single corridor until work in that corridor is complete.

Under Option C, initial impacts will center on downtown Everett and Tacoma and in neighborhoods around downtown Seattle. The distance between construction sites and the multiple alignments being worked on at once will likely mean slower construction in each segment, given the flow of construction funds and limits of regional construction capacity. The intensity of impacts along a given segment will be less than in other options, but will likely be more prolonged. Consideration should be given to measures that would maintain the mutual economic vitality of the region's primary centers during the initial construction phase that would affect Everett, Tacoma and Seattle.

2.3 Potential Rail/TSM Variations

Rail service and alignments may be modified near the ends of the North and South corridors to accommodate local surface rail operations. These variations may be incorporated if their performance characteristics do not significantly affect the performance of the regional rail system. Performance and

impacts of potential alignment variations will be evaluated in more detail during project level planning and environmental review.

2.3.1 North Corridor

Local surface rail in lieu of regional grade-separated rail operations has been evaluated along potential alignment segments within Snohomish County (see Section 2.2.3.2). The intent of instituting local surface rail would be to better serve local and intracounty service needs and reduce capital costs.

Local surface rail alternatives would use relatively exclusive, non-grade-separated right-of-way within existing roadways. Most intersections would be crossed at grade, with train movement expedited with signal preemption or other measures. Between intersections, the rail guideway would be protected by barriers or raised curbs. Trains would consist of two rather than four cars to be compatible with smaller, closer spaced stations and to minimize traffic conflicts.

Local surface rail vehicles would operate more slowly and with less schedule reliability than grade-separated regional trains. Transfer stations would probably be needed for passengers traveling between the local and regional portions of the rail alignment.

Depending on the location and length of the local surface rail operation, express bus service might be used to provide service from outlying areas to the northern terminus of the regional rail system and possibly downtown Seattle. Bus capacity constraints within downtown Seattle may limit this possibility.

The travel time between downtown Everett and downtown Seattle on the regional grade-separated rail system would be about 50 minutes. Incorporating a local surface rail segment within the corridor would increase the rail travel time by 25 to 30 minutes if local surface rail extended to the King/Snohomish county line, 8 to 12 minutes if local surface rail extended to the Everett Mall area, and 12 to 16 minutes if local surface rail extended to the Southwest Everett area.

Because of closer station spacing, local surface rail service would be more accessible to people using nonmotorized transportation. Preliminary ridership estimates suggest that local surface rail between downtown Everett and the Everett Mall would have slightly greater ridership than the baseline alignment, due to an increase in local ridership. However, local surface rail between downtown Everett and the Southwest Everett area would have lower overall ridership. Local surface rail along SR-99 between downtown Everett and the vicinity of the King/Snohomish county line would have substantially lower ridership.

Preliminary cost estimates indicate that the entire Snohomish County portion of the rail alignment would cost approximately $870 million for the through regional service baseline alignment (with at-grade service within downtown Everett and a spur to the Southwest Everett area), $500 million for the alternative incorporating local surface rail between downtown Everett and the county line, $890 million for the alternative incorporating local surface rail to Everett Mall, and $770 million for the alternative incorporating local surface rail extending to the Southwest Everett area.

Local surface rail operations are likely to increase traffic congestion along the alignment. Surface rail will reduce the amount of right-of-way available for vehicular movement and on-street parking and loading. Roadway traffic capacity will be reduced. Cross-street traffic along affected roadways will experience greater congestion due to the restriction of cross traffic to fewer intersections and the effect of signal preemption. Left turn movements between intersections would be precluded. Local emergency vehicle operations would also be affected.

Areas that experience increased traffic congestion may experience an increase in vehicular exhaust emissions. However, local surface rail may also reduce vehicle exhaust emissions by increasing local transit ridership and reducing the number of local buses. Hence, the net local air quality impacts are uncertain.

Other factors being equal, local surface rail operations are quieter than regional rail operations, due to lower average speeds. However, local surface rail operations would in general be located on streets with lower traffic volumes and speeds than freeway rights-of-ways used by much of the baseline alignment. Hence, background traffic noise within the local surface rail corridors is generally lower than noise in the regional rail service corridors. Potentially sensitive land uses, such as residences, tend to be closer to local surface rail alignment options than freeway rights-of-ways. Hence, the potential noise impacts may not be significantly different.

Development of a surface rail facility would probably involve full reconstruction of streets and sidewalks from property line to property line, including utility and drainage work within the more limited rights-of-way in the urban portion of the alignments. Additional right-of-way area might be needed for stations.

Right-of-way reconstruction will present an opportunity to provide roadway enhancements that could significantly improve the visual quality and pedestrian environment of affected roadways. Surface rail operations will have less visual impact than elevated grade-separated operations.

2.3.2 South Corridor

A surface rail line connecting Tacoma with the regional rail system and serving downtown Tacoma may be evaluated in the future, particularly if the rapid rail line is routed to Lakewood rather than downtown Tacoma. The impacts of building and operating surface rail to downtown Tacoma would be similar to those described for a surface rail system in the North Corridor (see Section 2.3.1).

2.4 Potential Rail/TSM Supplements

Additional alignments have been proposed to enhance the rail system's ability to serve populations and centers. These supplements are being evaluated for cost-effectiveness and potential to reduce transit travel times, contribute ridership, and reduce traffic congestion. If results are favorable, these alignments may be added to the System Plan by the JRPC. If one or more

are added to the System Plan, the impacts would be studied in detail during project-level environmental review.

The potential supplements are not crucial to the operation of a regional system. Because of this, the operating characteristics would differ from the rest of the system. Some additions could operate at-grade on barrier-separated tracks at slower speeds than the rest of the system. The advantages of at-grade rail operations over buses are increased capacity, slightly higher speed, and reliability.

Congestion Pricing

Under congestion pricing, use of major automobile transportation facilities would be regulated with tolls and/or permits to limit the number of vehicles using the facilities. This would provide both a financial base for transit and HOV improvements and a means of reducing congestion on key facilities. Recent technology allows charges to be made to users electronically, rather than with toll booths. Congestion pricing would have some equity issues, since financial impacts on lower-income individuals would be greatest. Privacy issues would also need to be resolved, since a computerized system could track individual travel habits. Land use and traffic impacts could also occur in areas without congestion pricing. However, congestion pricing could be a viable supplement to any of the build alternatives to reduce peak auto travel, stimulate transit ridership, and increase the use of HOV lanes and transitways, and it will be explored in future planning.

2.4.1 North Corridor

2.4.1.1 Ballard to Laurelhurst Rail Service

A supplementary alignment could extend east from Ballard through Fremont, Wallingford, the University District and Laurelhurst. A Metro study (Parsons/Kaiser 1991) concluded that at-grade light rail or enhanced bus service would be feasible and attract 6,200 more daily transit riders than existing bus service by 2020. Total daily ridership might pass the capacity of bus service but be within the capacity of light rail. Enhanced bus service or light rail could have serious impacts on parking, the availability of loading zones, and traffic along the corridor. However, replacement parking and loading zone access would be developed as a component of the project. Metro is also evaluating streets parallel to Northeast 45th for enhanced transit service.

2.4.1.2 Seattle to Everett Commuter Rail

A preliminary analysis has been made of the potential use of 34 miles of existing Burlington Northern Railroad (BNRR) tracks between downtown Seattle and downtown Everett for commuter rail service. The alignment includes about 27 miles of double track and 7 miles of single-track, the latter in intermediate sections. Much of the alignment is a series of curves with few tangent sections and only limited minor grades.

Under the preliminary service concept, service would begin at a new station and multi-modal transportation center east of downtown Everett in the vicinity of Smith Avenue, Pacific Avenue and the Interstate 5 overpass. This

station would include a large park and ride lot, supporting bus loading and turn around areas, and a drop off area. The commuter rail train would pass through the single-track tunnel under downtown Everett to the existing Amtrak Station on the Everett waterfront, which could accommodate bus and passenger car drop off zones and draw walk-on patronage. From there the line would continue along the Puget Sound shoreline to a new station in Mukilteo near the Washington State Ferry Terminal. Due to space restrictions and local traffic congestion, this station would probably include only limited park-and-ride spaces and bus and auto loading. A shuttle bus could connect the station to major employment centers in the Paine Field area. The station could possibly also be served by shuttle service from a remote park-and-ride. From Mukilteo the line would continue south to a station in Edmonds. The existing Amtrak station could serve as an interim station near the existing Washington State Ferry terminal, with space for a bus turn around and drop off facility. Longer range commuter rail plans will probably include a station near the new planned ferry terminal location. South of Edmonds, commuter rail service would pass along the community of Woodway, cross into King County, and serve a station in the Richmond Beach area. A Richmond Beach station could accommodate a small park-and-ride lot , drop-off space, and a bus turn around. South of Richmond Beach, the line would pass through Richmond Beach County Park, below the Highlands, and through Carkeek and Golden Gardens parks in Seattle on existing rights-of-way. Trains would cross Salmon Bay on the drawbridge just west of the Chittenden Locks. The line would then turn to the southeast paralleling Salmon Bay and then south through the Interbay Yards. After passing under West Garfield Street, the line would parallel Elliott Avenue and cross Broad Street. South of Broad Street the line would parallel Alaskan Way and proceed through the downtown railroad tunnel to the terminus and possible interconnection with proposed South Corridor commuter rail service at 4th and Jackson. Preliminary evaluation indicates that local development plans and the narrow existing railroad right-of-way near the north portal of the downtown rail tunnel preclude a North Portal commuter rail station. A joint facility relating to the new Port of Seattle headquarters is possible, as is a station at 3rd and University.

Commuter rail stations would be developed off-line along siding tracks accessible from both directions, with high level platforms. Expected track work would include providing double track through the Interbay Yard and new station sidings. Track rehabilitation would be required to modify and upgrade some curves. Upgraded crossing protection would be provided, including new gates at currently unprotected or marginally protected crossings. Crossing improvements would include lengthening existing train detection circuits near at-grade crossings to account for higher train operating speeds. Additional signal blocks would be provided due to the increased service and higher train operating speeds. Site work would also include minor grading, utility relocation, and drainage improvements along selected portions of the right-of-way.

The preliminary capital cost estimates for implementing commuter rail operations is approximately $92 million (1991 dollars).

Service on the line would be provided by trains with locomotives and two to five bi-level passenger cars. Service would initially run during peak periods weekday only, from approximately 6 a.m. to 9 a.m. and from 4 p.m. to 7 p.m. Midday service could be added when warranted by growth in demand. As the number of trains per day increases, conflicts with freight traffic and

Amtrak operations could increase. This could result in longer run times and reduced reliability in maintaining published schedules.

A preliminary estimate of 2020 North Corridor commuter rail ridership, based on the described system and assuming express transit service is maintained within the SR-99/I-5 corridor between Everett and Seattle) includes 2,000 passengers boarding to and from downtown Seattle and mainland origins and destinations in the corridor, 400 reverse commute boardings primarily to downtown Everett and the Paine Field area, 200 boardings from Mukilteo ferry walk-ons, and 100 boardings from Edmonds ferry walk-ons. Some of the origins and destinations of these riders would be to the south of Seattle. Major factors affecting the eventual ridership of commuter rail operation include

- the extensiveness of feeder bus service to stations and the degree to which competing or parallel regional express bus routes are eliminated
- the frequency of commuter rail service, the actual speed of the service, and any relative speed advantages over competing express bus routes
- whether through service to Tacoma is operated on a one-seat ride basis
- the supply of park-and-ride spaces at stations
- future levels of service on connecting ferry routes
- parking costs at employment locations in the commuter rail corridor
- the potential presence of parallel passenger-only ferry service from Everett, Mukilteo, Kingston, and Edmonds to Seattle.

Based on the preliminary estimate of 2,700 daily boardings, commuter rail service could be provided by three train sets which with four arrivals at Seattle's King Street Station and three arrivals at the East Everett Station between 6 and 9 a.m. The afternoon peak period would be similar, except that four northbound and three southbound trains would be provided.

Improved track speeds could be obtained with modest track and signal improvements and approval by the Washington State Utilities and Transportation Commission and the City of Seattle. Assuming improved speed limits and assuming that the commuter rail train would have priority over all other rail traffic during the peak periods, it is estimated that the run time between the East Everett Station and the Seattle King Street Station would be about 55 minutes, including station dwell times. Run times would be 62 minutes in the absence of speed improvements. Headways between trains would range from 30 to 45 minutes.

Commuter rail service along the Burlington Northern rail alignment would result in minimal disruption of traffic because most of the railroad right-of-way is bounded by water to the west and there are few destinations other than beaches west of the right-of-way. However, commuter rail traffic could have localized adverse affects on rush hour traffic at some at grade road crossings in downtown Seattle and in the Everett area.

Park-and-ride spaces may be sharply limited, depending on specific siting options in Mukilteo, Richmond Beach, and Edmonds. If significant park-and-ride capacity is provided at these stations, they will contribute to increased local peak commute period traffic. At both Edmonds and Mukilteo, the additional traffic could conflict with ferry traffic. At Richmond Beach, weekday traffic volumes are relatively limited, with the exception of truck traffic from the Chevron facility at Point Wells. However, traffic

moving to a station and associated park-and-ride facility in Richmond Beach would have to pass through single family residential areas.

Commuter rail service between Seattle and Everett would increase the frequency of train passby and train horn noise affecting an extensive area of single family homes extending from Interbay to the Everett waterfront. Increased rail speeds would slightly raise levels of noise from passing trains. Maximum expected speed increases would be modest (5 to 10 mph) and would generally occur within the areas where existing speed limits are most restrictive. Although commuter rail service would be limited to daytime and early evening operations, it could affect the timing of other rail operations, possibly increasing in nighttime rail operations along the line. The increased train traffic would also increase the train generated vibration affecting nearby residences, although the level of vibration from commuter rail would probably be less than that from freight trains due to the significantly lighter train cars used for commuter rail services.

Without mitigation, increased train operations could contribute to increased hazards to pedestrians along the railroad alignment. The railroad passes through a number of parks and abuts miles of residential development where informal track access and crossing occurs. However, the introduction of commuter rail service would be accompanied by improvements in grade crossings to enhance pedestrian and vehicular safety. Increased fencing and electrically-controlled gates could reduce potential hazards to pedestrians.

Commuter rail operations could affect historical properties, historic districts, and archaeological sites in downtown Seattle, along the Puget Sound shoreline, in Mukilteo, and in Everett. Increased vehicular traffic, train movements, noise, and vibration could adversely affect historic districts or could encourage rehabilitation of nearby historic structures in or near the Pioneer Square Historic District, the Seattle Chinatown Historic District, "Historic Everett," or other historic districts or areas along the alignment. The alignment passes through or near a number of historic resources, including, but not limited to, the Great Northern Railroad tunnel, the Chittenden Locks, the Lake Washington Ship Canal Historic District, the railroad draw span bridge, Japanese Gulch, a historical archaeological site located east of Mukilteo, and the Rucker Hill Historic District in Everett. Care would be taken in constructing any new track segments to avoid identified historic properties and investigate any archaeological sites in the vicinity of construction sites.

The BN alignment passes across or near several known or potentially significant hazardous waste sites, including the East Waterway in Everett, the Unocal Edmonds Bulk Plant and the U.S. Defense Fuel Supply Point in south Snohomish County, and Alaska Pacific Fisheries, Balmer Yard, Interbay Yard, the Monterey Apartments site, and the Unocal-Seattle Marketing Terminal in north King County. These sites would probably not be disturbed by implementation of commuter rail service.

Bluff stabilization along portions of the rail right-of-way, if required, could affect local ground water flow, although the impacts would probably not be significant.

Construction of required track improvements could contribute to brief disruptions of freight or passenger rail operations along the line.

2.4.1.3 Express Passenger Ferry Service

Community Transit is evaluating a private sector proposal for express passenger ferry service between Everett, Mukilteo, Edmonds, Clinton, and Seattle. Such an operation could increase intercounty commuter capacity and slightly reduce of the volume of overland commuter trips within the north corridor. It would also require new parking facilities and increase peak-hour traffic volumes near ferry docks.

2.4.2 South Corridor

2.4.2.1 Rainier Local Surface Rail

If the Duwamish rail alignment were chosen, Rainier Avenue could become an at-grade supplemental alignment that could increase the rail system's ridership and service area. A Metro study (Parsons/Kaiser 1991) concluded that light rail along Rainier Avenue from downtown to South Henderson Street would be feasible, but would either require additional right-of-way or have serious traffic impacts.

2.4.2.2 SeaTac People-Mover Project

The proposed People-Mover project would use personal rapid transit (PRT) technology to serve the airport, hotels and other businesses in the Sea-Tac area. PRT technology uses automated vehicles on a fixed guideway. The small vehicles are used by an individual or small group traveling together by choice. The small guideways can be above ground, at ground level, or underground. The system would be a network of guideways with vehicles summoned for individual trips to provide non-stop, origin-to-destination service. This technology has never been implemented in public transit service to date.

The SeaTac People-Mover system would have 17 lane-miles of one-way elevated guideway along street rights-of-way. There would be 31 stations, located on an "off-line" guideway, such that vehicles could bypass stations and avoid intermediate stops. The system would be integrated into buildings wherever opportunities exist. Some stations could be located in the lobbies of new or existing hotels, office buildings and the Sea-Tac Airport terminal. Some stations would require stairways and elevators or escalators for access.

Up to 30,000 riders per day could use the PRT system being considered for 2010, based on a variety of assumptions, including:

- No competing shuttle services would be provided in the study area.
- Full development of the Aviation Business Center.
- 5,000 riders per day transferring from a nearby RTP rail station.

2.4.2.3 Renton Commuter Rail

The Regional Transit Project evaluated a possible extension of the commuter rail service to Renton. This would allow commuter rail service between Renton and Seattle and between Renton and Tacoma as an interim service until a rapid rail link is completed between Renton and the Seattle-Tacoma

rapid rail line. The evaluation covered alignment, operations, markets served, ridership and access.

Alignment Description

Commuter rail could serve Renton using an existing Burlington Northern branch line. The rail line branches from the main line at the Black River Junction, just north of the recommended Longacres station.

The distance from this junction to north Renton is 4.2 miles. The rails have six grade crossings with streets in downtown Renton.

Commuter rail service to Renton would require some modification to the track. Track exists today to allow direct service between Seattle and Renton. The portion of the junction that would allow direct service between Tacoma and Renton would need to be reconstructed. Other track and signal improvements would be needed to improve operating speeds.

Operations

Commuter rail could operate every 20 to 30 minutes between Renton and Seattle and Renton and Tacoma. The operating schedule assumes cooperation and flexibility on the part of Burlington Northern and Union Pacific Railroads in terms of shifting freight service to accommodate increased passenger service due to commuter rail.

As with the mainline commuter rail service, commuter rail service to Renton could begin within two years of receiving funding. Similar to the mainline service, operations would begin during peak periods only, with service to and from Tacoma, Seattle, and Renton.

Commuter rail service to Renton would use the same type of locomotives and coaches proposed for the mainline service. All vehicles and stations would meet requirements of the Americans with Disabilities Act. Renton commuter rail would not require additional maintenance and storage facilities. Locomotives and coaches would share maintenance facilities with the Seattle-Tacoma service.

Major Places or Markets Served

Renton commuter rail stations could be located in the vicinity of the existing "Spirit of Washington " depot to serve downtown Renton. A second station could be located between N. 8th and Park Avenue to serve the manufacturing areas in North Renton. A third station could be added in the future near the Black River Corporate Park as that area develops.

Assuming stations as proposed on the mainline and track and signal improvements, travel times would be 52 minutes between Tacoma Dome and North Renton and 25 minutes between King Street Station and North Renton. Passengers could transfer to rapid rail at Tacoma Dome, Longacres, Boeing Access Road, or King Street Station for access to other destinations.

Ridership

Daily two-way ridership would be approximately 3,000 with peak period service between Renton, Tacoma, and Seattle in year 1999. These ridership

estimates assume adequate bus feeder service to commuter rail stations and expansion of park-and-ride facilities as recommended in the draft System Plan.

2.4.2.4 Lakewood/McChord Rail Service

The Regional Transit Project completed a study of possible alignments and stations, operations, costs, and ridership for an extension of rapid rail to the Lakewood/McChord area. From the Lakewood/McChord area, the study identified potential future extensions to Fort Lewis.

Alignment Descriptions

Although the description refers to specific rights-of-way and facility locations, this is for study purposes only. Other alternative alignments and facility locations would continue to be considered. Detailed evaluation of specific alignments and facilities will occur during project-level environmental review if this proposal is adopted for the System Plan.

The Lakewood/McChord rapid rail could begin at the Tacoma Dome. From the Tacoma Dome, several alignment options are possible. These include right-of-way along I-5, South Tacoma Way, or portions of existing railroad right-of-way. The rail line would cross under the I-705 spur to follow either alignment. If on S. Tacoma Way, the rail would pass under SR-16 and Union Avenue. Rail on I-5 would be elevated to cross these and other major roads. To reach Lakewood, the alignment could use 100th St. SW.

A combination of at-grade and elevated configurations is possible, depending on the alignment. An at-grade alignment on S. Tacoma Way could operate in the median, with curb barriers from cross traffic except at major intersections such as S. 38th St. The rail line can be elevated to avoid impacts on traffic. Either alignment could operate at speeds of 35 to 40 mph, consistent with the rapid rail system in the region.

Operations

The Lakewood/McChord extension could operate as part of the rapid rail system. Trains from Federal Way and North Pierce County could operate to the Lakewood/McChord area. Based on the operating assumptions for the rapid rail system, this would mean that trains could run every 10 or 15 minutes to Lakewood/McChord.

Rail in downtown Tacoma could operate as part of the rapid rail system or as an independent rail spur. As an independent spur, trains could operate frequently, connecting the commercial areas and university areas with the Tacoma Dome station. Regional trips would transfer at the Tacoma Dome station. As part of the regional system, train frequencies would depend on the regional system and would likely be less often than as an independent spur, but fewer people would need to transfer.

Major Places or Markets Served

The Tacoma to Lakewood/McChord corridor has a variety of significant transit destinations that could be served by rail, including:

- Tacoma Mall and the surrounding commercial/residential community near 38th and Pine.
- South Tacoma business community along South Tacoma Way.
- Lakewood Mall and surrounding development.
- Military facilities with their combined civilian and military employment and resident populations. (Total civilian and military employment at these facilities exceeds 30,000, by far the largest employment base in Pierce County.)

In addition, some stations would have park-and-ride lots to allow automobile access, as well as transit access to the stations.

The Tacoma Dome station would be a major transfer point to other transit modes. From the Tacoma Dome station, people could travel to downtown Tacoma on frequent rail service, to northeast Pierce County and the Kent-Auburn valley on commuter rail, to South Tacoma and Lakewood/McChord on the rapid rail, or to Federal Way, SeaTac, Seattle, and other destinations on rapid rail. Since the Tacoma Dome station will also be a focal point for Pierce Transit services, transfers to the bus system would also be possible.

Extension to Fort Lewis

Rapid rail could extend service to the military employment and resident base by extending the line beyond the Lakewood/McChord area. Right-of-way along I-5 or within the existing railroad right-of-way could be used for rail service.

Ridership

Preliminary estimates indicate that 6,000 to 9,000 daily riders could be expected on rail between Fort Lewis and Tacoma, depending on the physical and operational scenario. Daily riders could be expected to increase from 7,000 to 8,000 on rapid rail north of the Tacoma Dome with rapid rail service to Lakewood/McChord.

Potential Environmental Impacts

Typical environmental impacts of a line between Tacoma and Lakewood or McChord would be similar to those described for other portions of the rail alignment in Chapter 3. Specific environmental issues and constraints that should be noted include:

- The Lakewood/Fort Lewis area is underlain by well-drained gravels which could provide some unique construction and dewatering problems if any underground facilities are envisioned.
- The Lakewood/Fort Lewis part of the corridor is very noisy due to air traffic at McChord Air Force Base and I-5 traffic. Construction and operations noise would probably be well-masked by preexisting noise. However, some residential areas do border the corridor and could be affected.
- Clover Creek and American Lake in south Pierce County are close to potential alignments and could be affected.
- There is considerable communication between surface and groundwater in the Lakewood area. Many lakes and ponds are fed by groundwater discharge from aquifers. The alignment under consideration comes to within about 500 feet of the lake at its southern end. If contaminants

from construction were allowed to enter groundwater, there might be some effect on water quality in the lake.

- o Extension south from Tacoma to Lakewood or McChord would increase the total impervious surface created due to construction of the rail system.
- o The Lakewood/McChord area includes various hazardous materials users and sites, including light industry, vehicle-related businesses, McChord Air Force Base, the Ponders Corner and American Lake Gardens Superfund sites, and Xytec Plastics and Associated Military Camp Murray MTCA sites.
- o Perkins Park and the Tacoma Country and Golf Club could be affected by the alignments under consideration.
- o Historically significant properties are located at Camp Murray adjacent to Burlington Northern tracks and at Fort Lewis. Commemorative trees (remnants of the "Boulevard of Remembrance" are located between I-5 and Burlington Northern tracks in three locations.

2.4.3 East Corridor

2.4.3.1 Eastside Commuter Rail

RTP has studied a commuter rail link between Renton and Bellevue along existing Burlington Northern right-of-way as an interim service before construction of the main rail system in this corridor. The line would provide two-way peak-hour service between South Kirkland Park-and-Ride and Boeing Renton, downtown Renton, and the main Seattle-Tacoma commuter rail line. However, daily ridership would be low, estimated at about 2,000.

2.4.3.2 I-405 Access Improvements

RTP is considering specific access improvements to the planned center HOV lanes along I-405 if, as is likely, these segments are not part of the initial eastside rail segments. These access improvements would consist of ramps giving buses direct access to I-405 center HOV lanes from nearby park-and-ride lots. Because of initial low projected ridership on these segments, bus service would have sufficient capacity to serve these areas until the 2020 system is built.

2.5 Surface Light Rail Systems

"Light rail transit" ("LRT") encompasses a range of overhead electrically powered rail systems that run either in mixed traffic or on exclusive rights-of-way. The term "light" usually refers to capacity, not vehicle size or weight. "Surface" light rail systems run at grade. They typically have average operating speeds of 5 to 20 mph and capacities between 4,000 and 12,000 persons-per-hour in each direction.

Light rail technology is flexible and adaptable. With grade-separated facilities, two or more linked light rail vehicles (LRVs) can carry relatively large numbers of passengers. When the system has an unobstructed trackway, it can convey passengers at relatively high average speeds. Light rail can also operate on surface streets and in mixed traffic where increased access is necessary and operational disruption can be minimized.

The level of service that can be achieved with surface light rail systems is significantly lower than that of grade-separated systems. The most important aspects of the level of service (speed, capacity and reliability) are discussed below:

Speed

A high-volume rail line should operate at an average speed that is competitive with automobiles traveling the same distance. A slow system will not attract a major share of potential transit demand. Speed is a function of several factors, including exclusivity of right-of-way, distance between stations, and dwell time at stations. A surface LRT system like MAX in Portland would operate at average speeds of 18 to 20 mph, relatively slow compared to the grade-separated Rail/TSM Alternative, which would average 35 to 40 mph.

Capacity

Surface LRT operating across intersections is typically limited in terms of train length and frequency. Train length will be limited to something shorter than a city block, since trains cannot block intersections when stopped at stations. Train frequency is also limited, since there must be time for cross traffic to clear intersections between trains. Conventional transit practice and highway standards suggest that when train frequencies are under 6 minutes, cross traffic on arterials will be affected to the extent that grade separation is necessary. Between 6 and 16 minute headways, traffic levels, levels of service on cross streets, and the importance of cross streets to the community and emergency services become important criteria for assessing operational feasibility. These constraints limit the capacity of surface LRT systems, as compared to grade-separated systems.

Schedule Reliability

Because surface LRT must deal with cross traffic and crossing pedestrians, slowdowns and stoppages will sometimes occur at intersections, particularly at peak hours when congestion or accidents prevent crossing vehicles from clearing the intersection. These considerations will reduce system speeds, schedule reliability, or both.

Land Use Consistency

In general, a light rail system would not serve regional land use objectives as well as a comparable rapid rail system (Table 2.8). The slower speeds and lower capacity would reduce its ability to support concentrating density into centers, as called for by Vision 2020 and emerging countywide planning policies. Additionally, it would be unlikely to strongly encourage joint development near its smaller stations.

While surface LRT has been very successful in some systems due to low-cost right-of-way or a very dense urban setting, its operating performance relative to grade-separated systems is generally characterized by slower speeds, lower ridership, lower capacity, and lower reliability. These characteristics mean that surface LRT is unlikely to satisfy the demands of a three-county system.

Table 2.8. Consistency of Surface Light Rail with Land Use Goals.

GMA and/or Vision 2020	
Encouraging growth in urban areas	w
Reducing sprawl	w
Encouraging efficient multimodal transportation	m
Encouraging economic development consistent with comprehensive plans	w
Retaining open space and developing recreating opportunities	m
Protecting environment and enhancing the area's quality of life	m
Encouraging citizen involvement in the planning process	s
Concurrency between public facilities and new private development	w
Encouraging historic preservation	m
Countywide Planning Policies	
King County	
Promotion of contiguous and orderly development and provision of urban services to such development	w
Siting public capital facilities of a countywide or statewide nature	m
Countywide transportation facilities and strategies	m
Joint county and city planning within urban growth areas	m
Countywide economic development and employment	w
Pierce County	
Designation of urban growth areas and distribution of 20-year population forecasts	w
Countywide transportation facilities and strategies	m
Promotion of contiguous and orderly development and provision of urban services to such development	w
Siting of public capital facilities of a countywide or statewide nature	m
Snohomish County	
Urban growth areas and population distribution	w
Transportation facilities and strategies	m
Contiguous and orderly development	w
Siting of capital facilities	m

n=nil; w=weak; m=moderate; s=strong

However, there may be a place for surface LRT in the system plan. It may be more appropriate toward the suburban ends of the alignments (i.e., Tacoma and Everett) and for local feeder lines where the demand for speed and reliability can give way to the need for flexibility that light rail transit offers in concentrated urban centers.

The above discussion makes some general observations about surface light rail systems, but no two light rail systems are truly alike. There is a very wide variation in both system configurations and the levels of service that they provide. It is essential that local factors, such as development patterns, population densities, system demand, and physical characteristics be taken into account in discussing any surface LRT system.

2.5.1 Rhododendron Lines (Regional Transit Alternative)

The Puget Sound Light Rail Society (PSLRTS) is a group of private citizens who have formed a non-profit organization to advance the concept of surface light rail transit (LRT) as a transit solution for the Puget Sound region. The PSLRTS includes a number of engineers and architects, as well as private

citizens with a wide range of backgrounds and skills. They have also engaged consultants with rail transit expertise to assist them in the development of their concept.

PSLRTS has been working on the Rhododendron Line concept for a number of years. Members of PSLRTS have widely publicized their plan and have presented their proposals at many public meetings, as well as at meetings of the JRPC, the ERP, Sounding Board and other groups.

The Rhododendron Line concept has evolved over time. The original proposal was a barrier-separated surface light rail transit network or "core system" comprised of two lines: a north-south line connecting Everett, Seattle and Tacoma following the SR-99 and SR-525 corridors and an eastside line linking Bellevue and Seattle via I-90. The original proposal also called for a comprehensive network of bus and transportation system management improvements for the region, similar to the TSM measures proposed for the three System Plan alternatives.

RTP's analysis of the original Rhododendron Line proposal concluded that while costs of the line would be lower than those of the comparable RTP line, ridership would also be much lower because of lower speeds, lack of service to high-demand transit markets like First Hill, the University District, and Northgate, lack of drive access to the system, and system capacity constraints. Consequently, cost-effectiveness was likely to be considerably lower than the Rail/TSM Alternative and, like the R2B2 proposal discussed below, was likely to be as low or lower than the TSM Alternative. There would also be significant impacts on traffic and air quality (due to increased congestion) along SR-99. For these reasons, surface rail along SR-99 alignment was not considered to be a viable alternative and was not evaluated further in the DEIS.

After the DEIS was issued, the PSLRTS presented a revised plan, which advances a number of new ideas and alignments. This proposal, referred to as the "Regional Transit Alternative," includes not only an extensive LRT system, but also proposed expansion of trolley bus routes and a variation of commuter rail service. The PSLRTS proposal is offered as a low-cost alternative to the RTP System Plan.

2.5.1.1 History

Over the past two years, the relationship between the PSLRTS and RTP has been characterized by a series of disagreements about the respective proposals. RTP staff and consultants reviewed and critiqued an early version of the PSLRTS proposal, pointing out a number of potential shortcomings of the concept. PSLRTS has issued a number of publications and given presentations which have criticized the RTP proposal. Both proposals have evolved significantly over the past two years. Many of the RTP criticisms of the Rhododendron Lines proposal (and the PSLRTS responses to those criticisms) are no longer relevant, as they relate to alignments which are no longer being proposed.

The following discussion describes and reviews the Regional Transit Alternative proposal as presented by PSLRTS in its November 1992 transmittal to Metro. Correspondence and testimony related to previous proposals, while included in the documentation of comments and responses to the DEIS, are not discussed further in this section.

2.5.1.2 The PSLRTS Proposal

Description

The PSLRTS proposal contains three major elements:

- o A 78-mile surface light rail system from Everett to Tacoma and to Bellevue on the Eastside.
- o "City-Link" City-Suburban Rail Service, described as a "pre-light rail system" operating on existing railroad rights-of-way from Tacoma to Seattle via the Green River Valley and from Tukwila to Kirkland via Burlington Northern trackage. This system covers approximately 52 miles.
- o Electric Trolleybus System Expansion of approximately 50 miles, primarily on existing diesel bus routes within the city of Seattle.

LRT Alignments.

North Corridor. The proposed North Corridor Alignments would use the Downtown Seattle Transit Tunnel (DSTT) through Seattle in its current configuration. The line would proceed north using one of the I-5 reversible lanes to Northgate and continue in the I-5 right-of-way to Roosevelt Way. It would then follow Roosevelt Way to SR-99 and proceed at-grade on SR-99 to 218th Street S.W. in Snohomish County. It would proceed in the old interurban right-of-way to SR-525, then on SR-525 back to SR-99 and follow SR-99 to Airport Road. The North Corridor Main Line would continue to Everett, with branch lines to Paine Field and Everett Mall.

South Corridor. From the DSTT, the line would use the E-3 Busway to South Spokane Street. There would be an underpass at South Spokane Street, and the alignment would proceed in the Union Pacific and the 4th Avenue South rights-of-way to East Marginal Way South. It would follow East Marginal Way South and railroad right-of-way along the west side of Boeing Field to SR-99. It would remain on SR-99 though SeaTac, Federal Way, and on to downtown Tacoma.

East Corridor. The proposed alignment would utilize the I-90 center roadway to I-405, where it would turn north in the BN right-of-way to NE 6th Street. The proposal includes several options to provide direct service to downtown Bellevue using loops on surface streets.

"City-Link" City Suburban Rail Service. The "City-Link" proposal would allow for conversion of the service to Light Rail Transit (LRT) when patronage levels and funding resources permit. It proposes to use either self-propelled rail-diesel cars or conventional commuter rail vehicles.

City-Link services would include a Seattle-Tacoma line via the Green River Valley and a Renton Line in the BN corridor from Tukwila to Kirkland.

Electric Trolley Bus System Expansion. The PSLRTS proposal calls for about 50 miles of new trolley overhead lines and trolley bus service. New trolley routes would serve Interbay, Ballard, Crown Hill, Northgate, Wallingford, Green Lake, Denny Regrade, Eastlake, University District, north Capitol Hill, Seattle Pacific University, Woodland Park, and several locations in southeast Seattle.

Cost

LRT. PSLRTS estimates that the proposed 78-mile surface LRT system could be implemented for a total cost of approximately $2.3 billion. This estimate is proposed to cover construction of trackage, stations, vehicle maintenance bases, and power and control systems. It includes a contingency fund and allowances for engineering and administrative costs. The average cost per mile for this system is $29.5 million.

City Link. The total projected cost includes approximately 52 miles of track, 15 stations and 14 train sets:

Green River Valley corridor		$227 million
Renton Corridor		$127 million
	Total	$354 million

Trolley Bus System Expansion. The estimated cost of the proposed trolley system expansion is $175 million. This accounts for 50 miles of new trolley lines at $3.5 million/mile.

2.5.1.3 Operations

LRT

The PSLRTS proposal sets forth the following operating characteristics for the surface LRT system:

- o *Surface operation*. The system would operate on the surface throughout the system with the exception of DSTT. There would be limited overpasses and underpasses in congested areas.
- o *Existing rights-of-way*. The system would be constructed primarily on existing public rights-of-way, including I-5, SR-99, the E-3 busway, and SR-525.
- o *Access* . There would be frequent stops, every 0.75 to 1 mile on average
- o *Frequent Service*. Trains would run every 5 to 10 minutes during rush hours and every 15 to 20 minutes during off-peak hours.
- o *Capacity*. The system could accommodate up to 18,000 passengers per hour per direction (assuming four car trains operating every two minutes).
- o *Speed*. Average speed of the system is calculated as about 31 miles per hour, not including slower running times through the downtowns of Seattle, Tacoma, Bellevue or Everett.
- o *Safety*. System would include automatic traffic signal preemption at all grade crossings using state-of-the-art technology.

"City-Link"

The proposed "City-Link" system would have very similar operating characteristics to the commuter rail element of the RTP recommended draft System Plan.

Electric Trolley Bus System Expansion

Both the extent of the system and the proposed operations are very similar to the trolley bus expansion which is included in the TSM component of the RTP Rail/TSM Alternative.

2.5.1.4 Analysis and Comparison

Bus System

The PSLRTS proposal advocates a significant increase in bus service, particularly with a number of specific routes that could be converted to electric trolley bus service. The total cost included in the PSLRTS proposal for bus services is $175 million, the cost of the trolley system expansion.

The RTP recommended draft System Plan also proposes a significant increase in bus service. The bus service increase is based on a detailed study of the service areas and the number of bus hours anticipated to provide the higher level of service. The plan includes approximately $1.3 billion for purchase of the buses needed to provide the increased service and for bus operation and maintenance. The RTP recommended draft System Plan also includes $1.2 billion for new capital facilities to support bus services. This includes bus bases, trolley system expansion, transit centers, freeway access improvements, and a number of types of arterial street improvements to improve the speed and reliability of the bus service. The total portion of the RTP recommended draft System Plan cost estimate (through 2010) dedicated to improvements in bus service is $2.5 billion.

Both the PSLRTS and RTP proposals describe major bus service improvements. The RTP recommended draft System Plan includes the total amount needed to fund such improvements, whereas the PSLRTS proposal includes funding for only a relatively small element of the bus program.

"City-Link"/Commuter Rail

Again, the PSLRTS proposal and the RTP recommended draft System Plan include very similar notions of commuter rail type service. The PSLRTS proposal has broader coverage in that it includes a line from Tukwila to Kirkland, which is not in the recommended draft System Plan. This alignment was studied as part of the RTP but was not included in the recommended draft System Plan because of projected low ridership, the high cost of upgrades to the existing rail line, and environmental impacts. A shorter segment from Tukwila to north Renton is being reevaluated for possible inclusion in the Final System Plan.

The commuter rail service from Tacoma to Seattle is estimated to cost $180 million in the RTP recommended draft System Plan. The somewhat larger "City-Link" element of the PSLRTS Proposal is estimated at $354 million.

Rail Operations and Capital Replacement

The estimated cost of the RTP recommended draft System Plan includes funds to operate the rail system as segments are completed. It also includes an allowance for replacement of capital facilities as required through 2010. These items account for $600 million of the estimated RTP costs.

The PSLRTS plan does not include operations or capital replacement costs.

Rail System

The major differences in the two proposals lie in the configuration and operation of the respective rail elements. These differences are subsequently reflected in the cost of the proposals. Although the RTP has evaluated a much larger rail system, as reflected in the Final EIS, the recommended draft System Plan recommends a scaled-back investment in new rail facilities. The recommended draft plan is appropriate for comparison with the PSLRTS proposal. Some of the key comparisons are summarized as follows:

Item	PSLRTS	RTP
Miles of Track	77 mi.	88 mi.
New Rail Stations	66	52
Park and Ride Spaces	6,400	31,000
Rail Vehicles	250	320
Estimated System Cost	$ 2.3 billion	$ 6.2 billion

2.5.1.5 Cost

The RTP developed a cost estimating methodology that was intended to respond to widespread criticism that many transit projects throughout the U.S. have experienced significant cost overruns during the past decade. To assure that the RTP did not follow this trend, the legislation that initiated the High Capacity Transit (HCT) studies called for the appointment of a panel of outside experts to review the program and ensure that the cost estimates were adequate.

The RTP proceeded to define alternatives with a level of conceptual engineering that is unprecedented in any previous system planning effort. Through this work, RTP identified grades, curves, and both constructed and natural obstacles encountered along conceptual alignments. This was done so that the cost of dealing with such conditions could be accurately reflected in the project capital cost estimate. The system profile, whether the rail line is at-grade, aerial or underground, was analyzed with respect to availability of right-of-way and impacts on those specific areas the system was designed to serve. In estimating station costs, the RTP approach was to include the cost of improvements needed to assure good pedestrian, bicycle, auto, and bus access to stations. Finally, contingencies and allowances for engineering and administration are included at levels that are consistent with professional cost engineering standards and federal guidelines.

Cost estimates for the PSLRTS rail system reflect a more general approach of developing unit costs for various system components and multiplying such costs by the estimated quantity of each item. This is a reasonable approach to develop "order of magnitude" estimates, provided that adequate contingencies are added to the baseline estimates to cover unforeseen costs. The lower the level of engineering done to define the project, the higher the contingency should be.

The proposed PSLRTS light rail system is estimated by its proponents to cost $2.3 billion, about $3.7 billion less than the cost of the RTP rail system. Much of the cost difference is due to the estimating approach. If the RTP's methodology were applied to the proposed PSLRTS system, the cost of that system would be 50 to 70 percent higher than the current estimate. This accounts for between $1.2 and $1.6 billion of the total cost difference between the systems.

The remainder of the difference in cost, about $2.1 to $2.5 billion, is primarily related to differences in the number of markets served by the two systems, the frequency of service provided, and the capacity of the system.

2.5.1.6 Markets Served

The recommended RTP alignments, including a number of alternatives which will need to be analyzed further as the project proceeds, serve all of the markets that the PSLRTS rail system would serve except for the Duwamish industrial area in South Seattle. RTP provides direct rail service to a number of additional markets not served directly by the PSLRTS system. These include: First Hill, Capitol Hill, University District, Rainier Valley, East Bellevue, Overlake, Redmond, and the I-405 corridor between Bellevue and Totem Lake. The JRPC concluded that the benefit of connecting these centers with the regional rail system and the increased ridership produced by these connections justified their inclusion in the recommended draft System Plan.

Because the PSLRTS proposal has more total stations than the RTP system, PSLRTS claims that more places can be served. With 66 stations in the 77-mile PSLRTS system, the average distance between stations is about 1.2 miles (not 0.75 to 1 mile, as stated in the PSLRTS proposal). In any rail system, there is a trade-off between the number of stations and the speed of the system. RTP ridership models have analyzed this trade-off in detail in efforts to optimize system speed and access to the system. This type of analysis will be continued at an even more detailed level as stations are defined during project-level planning.

2.5.1.7 Level of Service

There are three components of level of service that are considered in a transit system: speed, reliability and capacity.

Speed

The PSLRTS proposal states an average system speed of 31.24 mph, not including slower running times through the downtowns of Seattle, Everett, Tacoma, and Bellevue.

The RTP uses a computer simulation to calculate speeds and travel times. The model accounts for grades, curves, station stops, acceleration, and braking of trains based on characteristics of current rapid rail vehicle technology. When applied to the PSLRTS proposal, this model indicates that, in non-grade separated portions of the alignments, travel times would be considerably longer than those shown in the PSLRTS proposal. The results of that analysis are summarized as follows:

<u>North Corridor</u>. For the PSLRTS alignment, the RTP staff calculates a travel time of 69 minutes from Everett to Seattle, or about 12 minutes longer than the PSLRTS-calculated time. The RTP run time from Seattle to Everett is 51 minutes.

<u>South Corridor</u>. RTP staff calculations result in a travel time of nearly 86 minutes from Tacoma to Seattle, or 23 minutes longer than the PSLRTS calculation. The RTP run time from Seattle to Tacoma is 56 minutes.

East Corridor. Travel times from Bellevue to Seattle would be similar for the RTP and PSLRTS systems, as the PSLRTS alternative is mostly grade separated in this corridor.

For both the North and South corridors, RTP simulations show average speeds for the rail line of about 5 mph less than the PSLRTS calculations, i.e., 27 mph in the north and 23 mph in the south. The same type of simulation for the RTP rail system results in average speeds of 36 mph for both the North and South corridors, including travel time through the downtowns of Everett, Tacoma and Seattle. The difference is due to the number of station stops and restrictions encountered by running at-grade in the SR-99 corridor.

Reliability

Surface LRT with traffic preemption typically achieves a satisfactory level of reliability as compared to automobiles or buses. Even though the current PSLRTS proposal has a much greater amount of grade separation than the previous proposals, it is estimated that there are still over 300 street crossings or merges between Everett and Tacoma. Each of the crossings and merges presents an opportunity for both auto and pedestrian traffic to delay trains, despite the best efforts at traffic signal preemption and control. This results in lower reliability than the RTP system, which operates primarily in exclusive rights-of-way.

Capacity

While absolute numbers for capacity and rail systems are typically quoted based on vehicle loadings and headways, it is important to address capacity as it relates to level of service.

The RTP has a calculated capacity of 22,400 passengers per hour. Because of the configuration of the system, particularly the exclusivity of right-of-way and the design of the control systems, trains can be operated at 90 second intervals without diminishing the speed and reliability of the system. The forecast peak demand in 2020 is about 15,000 passengers per hour. Thus, the system design incorporates an "expansion factor" of about 50% to accommodate future growth in ridership.

The PSLRTS rail system is based on an operations plan which calls for four-car trains at five minute intervals. Peak capacity, using the same length of trains and same loading factor per car as RTP, would be about 6,800 passengers per hour. With a good operating plan and sufficient controls, train frequency could be increased to a train every four minutes without diminishing system speed and reliability. This would yield a peak capacity of 8,400 passengers per hour.

While it is possible to increase the frequency of the trains to attain higher capacity, the speed and reliability of the system as well as its efficiency would begin to diminish as frequencies increase. While operating cost is not addressed in the PSLRTS proposal, it would take more equipment and operators to provide the PSLRTS service due to the longer system cycle times.

2.5.1.8 Ridership

The PSLRTS proposal expects that an attractive, landscaped surface LRT system will draw medium density development to the rail corridor, increasing ridership on the system. This would require changes in existing land use plans, public and private investment, and a supportive economic climate, none of which will automatically occur. An FTA report has demonstrated that many recently built rail system overestimated potential ridership by assuming redevelopment scenarios that never took place. Based on this report, FTA and ERP guidelines for ridership estimation do not allow RTP to assume population or employment concentrations beyond what can reasonably be forecasted in the absence of rail.

Several factors indicate that the Rhododendron Lines would have a lower ridership than the Rail/TSM Alternative:

Markets Served

The Rhododendron Lines do not serve major ridership generators, including First Hill, Capitol Hill, and Rainier Valley, which together make up a large portion of system ridership. Analysis of the Marginal Way alignment for the RTP System Plan indicates that gains in ridership due to directly serving the Boeing plant in the Duwamish valley would not offset loss in ridership from Rainier Valley.

The proposal would only indirectly serve the University District, the second largest transit trip generator in the region, so it would not capture the full potential of that market.

Speed

As noted above, the speed of the surface LRT system is reduced by its at-grade alignment, station spacing and dwell time at stations. Travel time is a critical consideration in attracting system ridership. If transit speeds are not high enough to be competitive with other modes of travel, particularly the automobile, it will not be successful in attracting high levels of ridership.

System Access

With only 6,400 park-and-ride spaces, the PSLRTS proposal severely limits auto access to the rail system. Eliminating this type of access to the rail system will discourage riders who are not conveniently served by feeder bus or rail but are willing to drive to the system.

Capacity

As noted above, the peak-hour capacity of a surface LRT system would be much less than that of the RTP system. This would constrain ridership, even if ridership demand was high.

2.5.1.9 Traffic Impacts

Reversible Lanes

The current PSLRTS proposal would utilize the I-5 reversible lanes from Convention Place Station to Northgate. This alignment was studied in detail as part of the RTP System Planning Effort.

For the rail line to enter the reversible lanes from Convention Place Station, it has to cross the entire reversible lane section. This effectively eliminates the use of the reversible lanes for all other traffic south of Stewart Street. This displaced traffic would add to the already serious congestion in the I-5 mainline. North of Stewart Street, the PSLRTS proposal would occupy two of the reversible lanes. It is estimated that this will displace over 41,000 cars per day in this already congested corridor. The PSLRTS north alignment shows the rail line displacing only one lane of traffic. While possible, this results in substandard highway conditions (no shoulders or shy distances) which would require WSDOT and FHWA variances.

SR-99

The PSLRTS proposal would take two general purpose lanes from SR 99 in addition to the center turning lane or a parking lane. Depending on the configuration of stations, additional right-of-way would be either purchases or taken from the existing roadway at station locations.

Two lanes of surface LRT would theoretically absorb more than the number of people displaced by loss of these lanes. However, given travel patterns in the corridor, it is anticipated that traffic levels would still be higher than today in 2020 even with an LRT line. The loss of a significant amount of roadway capacity is expected to have severe adverse traffic impacts throughout the corridor, with spillover effects on neighborhood streets.

Operation of a surface LRT system would also have serious impacts on east-west traffic crossing SR 99. The PSLRTS proposal has added a number of flyovers at critical intersections to help relieve this impact. However, with the high degree of signal preemption proposed throughout the corridor, east-west traffic impacts would still be significant.

2.5.1.10 Implementation Schedule

The PSLRTS states that its 78-mile system can be in full operation in ten years after the start of construction. The conversion and retrofit of the I-5 Ship Canal Bridge, the many neighborhood environmental impacts and their mitigations, permitting processes, and other work restrictions will make it very difficult to maintain this schedule.

The 88-mile RTP system is anticipated to be complete within 13 to 15 years after the start of construction. In any case, the difference in schedules between the two systems is realistically about 3 years, not 15 to 20 years as stated by the PSLRTS.

2.5.1.11 Conclusion

Over the past three years RTP has studied many potential rail alignments in detail. The alignments proposed by the PSLRTS have all been analyzed as part of this effort. In this analysis, the potential for implementing lower cost, at-grade profiles was exhausted before moving to a more costly aerial or subway profile. The tradeoffs between system speed, number of stations, system access, ridership and costs were all studied in great detail.

Surface LRT options were analyzed to the point that it became clear that these options did not adequately serve the goals and objectives of the Regional Transit Project. Because of the superior performance of the grade-separated RTP system in terms of consistency with land-use objectives, level of service, and ridership, it was recommended as the rail technology in the recommended draft System Plan.

This recommendation is consistent with the analytical approach of the RTP which was designed to assure that cost and ridership projections would be realistic, and would avoid the much-publicized pitfalls experienced in past transit planning efforts. The methodologies and results employed in the RTP process have had extensive and favorable review by the Expert Review Panel.

Finally, it should be recognized that System Planning is the first step in a long process required for implementation of a transit project. While the System Plan establishes the basic system requirements, each aspect of the system will be analyzed in greater detail through the Alternatives Analysis, Predesign and Final Design phases of the project. Continued efforts will be made to find ways to reduce costs while maintaining levels of service. This process will likely include further analysis of surface LRT segments in a number of areas in the region.

2.5.2 R2B2

The Institute for Transportation and the Environment (IfTE) proposed R2B2 (Rail*Rail*Bus*Bike/Pedestrian) as an at-grade light rail system serving shorter trips within urban centers and their neighborhood commercial corridors and subcenters, R2B2 emphasizes converting automobile street and highway capacity to transit, pedestrian, and bicycle capacity and maximizing pedestrian and bicycle travel within the urban area. To connect regional centers, R2B2 proposes an expanded point-to-point express bus network on HOV lanes, completing the region's planned HOV system, and converting general-purpose lanes to HOV lanes before building new lanes. Bus service would be expanded and reoriented to increase ridership in outlying areas.

R2B2 proposes a 42-mile surface light rail system serving Seattle, Mercer Island, Bellevue, Tukwila, and SeaTac, as well as separate systems in Tacoma and Everett. Rail would operate at grade in existing rights-of-way or, very rarely, in tunnels and on aerial structures where no alternative exists. King County rail corridors would include downtown Seattle to Northgate by way of Aurora, downtown Seattle to Factoria on I-90, downtown Seattle to SeaTac on Burlington Northern tracks and SR 518. Other possible alignments include 15th NW to Northgate through Ballard and Eastlake to the University District and Northgate. R2B2 suggests that converting right-of-way within existing transportation corridors to surface light rail would be a cost-effective way to increase ridership and capacity of the transit system.

2.5.2.1 Philosophy

R2B2 proposes at-grade light rail on existing roadways as a means of reducing the costs and construction impacts of a rail system. While the proposal would result in significant reduction of road and intersection capacity along some arterials, proponents of R2B2 consider that to be in line with a philosophy of discouraging automobile use. Similarly, R2B2 would

avoid use of park-and-ride lots, both so as not to encourage driving and to avoid neighborhood impacts. Instead, the proposal would emphasize feeder bus service and facilities for bicycle and pedestrian access to the system.

2.5.2.2 Technical Analysis

RTP analyzed the feasibility of R2B2's King County rail system as part of a potential RTP alternative. The analysis assumed that the rail system would operate against the background of the TSM bus system. The Northgate/Rainier Valley line would operate along the Seattle waterfront, as proposed by IfTE at that point, rather than 3rd Avenue or the downtown transit tunnel. The lines to Factoria and SeaTac would share the downtown transit tunnel with express buses.

Cost

The Seattle R2B2 rail lines would cost about $2 billion, $1 billion less than the equivalent RTP rail segments. Combined with TSM capital improvements, R2B2 capital cost would total about $6.6 billion.

System Capacity

R2B2 would operate its east and south lines in the downtown tunnel by alternating trains and buses. The technical problems of operating buses and trains together would reduce the tunnel's passenger capacity below what it would be when operating buses or trains alone. About 90 buses per hour could operate through the tunnel, about 100 fewer than the maximum possible under the TSM or Transitway/TSM Alternatives. The displaced buses would use surface streets. However, transit capacity on downtown Seattle surface streets is limited by the ability to move buses through bus zones and intersections. Transit already uses 50 percent of available curb space and lane capacity in downtown Seattle during peak hours. Just as under the TSM Alternative, there would not be enough street capacity to meet transit demand by the year 2020.

System Ridership

Four factors would reduce potential ridership on the R2B2 system, as compared to the three RTP build alternatives. The first is the bus capacity constraint in downtown Seattle noted above. This could result in a loss of 17,000 more potential daily riders than under the TSM Alternative.

Second, the surface light rail routes to Northgate and Rainier Valley would run at relatively low speeds, as compared to the RTP system, to accommodate traffic at some intersections. Although signal prioritization could increase speeds to some extent, signal prioritization could probably not be used at congested intersections, since frequent interruption of signal cycles would further degrade intersection level of service. Low speeds would reduce potential ridership, since the lines would be less competitive with automobiles and non-motorized transportation. While there might be some ridership gain, as compared to the TSM Alternative, the ridership gain would be limited.

Third, the rail lines on the Seattle waterfront do not serve the main areas of downtown employment. While some different riders would be gained by increasing waterfront service, there would be a net ridership loss of about 10

percent in the SR-99 North Corridor and about 1,800 daily riders in the Rainier corridor, as compared to the TSM Alternative. If the lines followed surface streets in the main part of downtown Seattle (e.g., 3rd Avenue), they would further reduce surface bus capacity, potentially canceling out any ridership benefits.

Finally, R2B2 would not build any new park-and-ride facilities, which would limit ridership gains. R2B2 proponents believe some of the ridership could be regained with increased feeder bus service. However, feeder buses and park-and-ride lots serve somewhat different markets, and some suburban trips cannot be effectively served with feeder buses. Since the proposed levels of RTP feeder bus service are already based on demand forecasted by the ridership model, increases in bus service would have a limited effect on ridership. Limiting drive access to the system would result in a net ridership loss. Because ridership loss would depend on the particular configuration of suburban service and could be solved by building some park-and-ride lots, estimated ridership for R2B2 was not reduced for this factor.

R2B2 was found to attain slightly less than the ridership attracted by the TSM Alternative. R2B2 would continue to connect most centers using express bus service, which would maintain ridership levels in those corridors. As under the TSM Alternative, ridership would increase in outlying areas due to the expansion of community transit and bus service.

Traffic Impacts

R2B2 proposes to use right-of-way within existing transportation corridors for an at-grade surface light rail system. This would result in reduced capacity on several major arterials. For example, Aurora Avenue, currently a six lane arterial carrying up to 78,000 trips per day, would be reduced to four-lane vehicular traffic and a two-way rail system.

R2B2 would have severe impacts on traffic in corridors proposed for surface rail. Unlike the RTP alternatives, which seek to increase transit carrying capacity while limiting traffic impacts, R2B2 aims to create an environment conductive to transit, bicycles, and pedestrians by reducing arterial automobile capacity. Capacity reduction will significantly increase traffic congestion, with associated impacts on local air quality and adjacent neighborhoods. The proposal assumes that over time SOV users would shift to transit, which would increase ridership and reduce congestion. However, in the short term many of the affected trips would seek alternate routes, resulting in increased congestion in residential areas.

Schedule

R2B2 proposes that the 43-mile surface rail system could be completed by 1998, three years earlier than initial RTP segments. This schedule assumes that the limiting schedule factor is building major facilities for the RTP system, in particular the North and South Corridor tunnel segments. In reality, overall construction time is more dependent on contract packaging than on the type of work. The real limiting factor is the time required for preliminary engineering, alternatives analysis, and project-level environmental review before construction and the time needed to construct and test traction power, signals and control systems, maintenance and storage facilities, and rail vehicles during and after guideway and station construction. These components of system construction would take similar

amounts of time for any system. Because of this, there is little or no time advantage for R2B2 in terms of initial date of operation.

Conclusion

R2B2 was proposed as a lower-cost, more easily implemented surface rail alternative for the region. Analysis showed that it would indeed be lower cost, would have fewer regional construction impacts than the Rail/TSM Alternative, and would substantially increase ridership over the No-Build Alternative. However, R2B2 reduces the passenger-carrying capacity of transit in downtown Seattle, even compared with the all-bus TSM Alternative. Because of this loss of capacity, as well as relatively low speeds and circuitous routing on two of the proposed rail lines, system ridership would be slightly less than under the TSM Alternative, at a considerably higher cost. R2B2 could have significant impacts on traffic and air quality on arterials where traffic lanes were used for the rail system. Even with some modifications to the R2B2 proposal to increase ridership, it would be unlikely to be as cost effective as the TSM Alternative. For these reasons, R2B2 was not considered to be a viable alternative and was not evaluated further in this EIS.

2.5.2.3 Evolution of R2B2

In response to the DEIS, no new or revised proposals were formally presented by the IfTE. However, discussions between R2B2 proponents and RTP staff have continued. The R2B2 proponents continue to advocate that shorter, less expensive surface light rail lines be built in urban areas of the region as the initial rail transit investment.

2.6 Other Alternatives Considered but Not Analyzed in This Environmental Impact Statement

Many alternatives were suggested during public comment on the Vision 2020 EIS and during the formal RTP scoping process. Some of these were considered and screened from further analysis because they did not meet the objectives of the Regional Transit Project. Others were variations of the alternatives currently under consideration. These alternatives are summarized below, with an explanation of why they were not considered in this EIS.

2.6.1 Extensive Busway System

The results of the scoping process for Metro 2000, which was used for initial RTP System Plan scoping, included as an alternative an extensive system of busways following the same corridors as the proposed rail system. Initial costing and conceptual planning indicated that, given the same alignments, a high-capacity rail system would cost the same or less than a comparable busway system, while having superior capacity. Capital costs would be higher for a busway system because:

- Busways require wider rights-of-way, increasing land and construction costs. The wider right-of-way is due to the need for a breakdown/passing lane, which is not necessary for a rail line, since disabled rail cars can be pushed to the next station or siding.

- Busways in tunnels require more safety features than rail lines. This is because buses would be dual-powered, i.e., have both combustion and electric motors, and would therefore be carrying explosive fuels, increasing the risk of fire or explosion in case of an accident. Using all-electric buses would reduce the safety problem, but would also reduce operational speeds and flexibility.

Operations and maintenance costs for a high-capacity all-bus system were expected to be higher than for rail, largely due to the higher number of drivers needed to transport a comparable number of patrons. Other significant contributors to higher busway costs included higher vehicle maintenance costs and lower service reliability.

While busway capital and operations costs proved comparable to or higher than those for rail, system capacity and performance characteristics clearly favored rail technology. Because of the ability to physically link rail vehicles, significantly greater numbers of riders can be transported to and through any given location. This capacity issue was of particular concern between and within some of the region's larger centers, where even busway technology is clearly unable to handle projected future levels of transportation demand.

The extensive grade separation envisioned in the busway alternative also eliminated the main advantage of bus technology over rail - the ability of the bus to conveniently enter and exit the busway in order to provide express and local/circulation service, thereby reducing transfers.

Service reliability was another key system performance criterion that favored the application of rail technologies over extensive busways. While busways were recognized as being able to provide a level of service exclusivity and reliability well in excess of conventional bus service, busway service would be subjected to the same service and performance irregularities as automobile traffic at busway access points and during the collection and distribution portions of trips, both of which invariably require some use of local streets and arterials.

For these reasons, the extensive busway alternative was dropped from consideration and the less costly Transitway/TSM Alternative, which retained many of the attractive features of busway service, was developed to take its place (Parsons/Kaiser 1993).

2.6.2 Mixed Rail and Transitway Operations

This FEIS assumes that either a rail or a transitway system would be developed for rapid transit. However, a transitway could operate in one of the three major corridors, with rail in the other two corridors, or vice versa. A crucial issue of such a mix would be the technical problems associated with running both trains and buses on the same alignment in the Downtown Seattle Transit Tunnel. Joint operation would be feasible but would require reducing bus and train frequency below that which could be achieved by a single mode, thus reducing the tunnel's capacity. Travel times through the tunnel would be increased by 29 per cent with mixed operations (Manuel

Padron 1989). This mode of operation would probably be used during initial phasing of the Rail/TSM Alternative, until rail volumes in the tunnel made this impossible.

Otherwise, a mixed system's impacts would be a combination of rail impacts in the rail corridor(s) and transitway impacts in the transitway corridor(s). Except for Seattle CBD operations, discussion of systemwide impacts would be similar. If the JRPC chooses a rail/transitway combination, effects of mixed operation would be evaluated in future project-level environmental review.

2.6.3 Using Existing Freeway or Arterial Lanes for Rail or Transitway

Using existing general-purpose lanes instead of new rights-of-way for rapid transit facilities has been frequently proposed at community meetings. Except in a few areas, RTP has not proposed using existing lanes for rail or transitway. RTP's general policy is that HOV lanes should be added to existing general-purpose traffic lanes. Where capacity is sufficient to allow conversion of a general-purpose lane to an HOV lane, such conversion will be considered in lieu of adding a lane.

RTP studied the probable effects of taking general-purpose freeway lanes for transit or HOV use on I-5, SR-520, I-405, and I-90. The principal finding of the study (Parsons/ICF Kaiser 1991) is that restricting general-purpose lanes on a congested freeway for transit or HOV use would cause severe congestion on the remaining lanes, bringing peak hour traffic to a virtual standstill and severely affecting air quality. Some drivers would switch to HOVs under these conditions, but many trips simply would not be served. Traffic congestion impacts on I-5 would be high enough to call into question the viability of the North Corridor transitway. Over 1500 peak hour trips could not be served if a lane were converted on SR-520 and over 1000 trips could not be served after converting a lane on I-405. Conversion would likely minimize or eliminate the air quality and energy benefits of HOV facilities. However, using existing lanes on freeways that are not as heavily traveled, such as I-90 between Issaquah and Bellevue, may be a viable way to reserve future HOV capacity.

2.6.4 System North of Snohomish County, South of Pierce County, or East of King County

Public comments were made advocating a high-speed rail system serving the I-5 and I-90 corridors as far north as Vancouver, British Columbia, as far south as Portland, Oregon, and east to Spokane. A high-speed rail line linking major cities in the I-5 corridor or linking Seattle with eastern Washington could be a useful transportation improvement. WSDOT is currently studying these options. These lines would enhance interregional mobility, providing energy-efficient alternatives to driving or flying. However, such lines, to maintain competitive speeds, would have only limited stops in the central Puget Sound region. They would not address the need for efficient mass transit within the metropolitan area and would do little to enhance local mobility. RTP would enhance the ridership of these lines by coordinating its planning with WSDOT and working to provide good

connections from high-speed rail stations in the three-county area to other regional destinations.

A System Plan objective is to respond to urban growth boundaries proposed under growth management. If the intraregional rapid transit system extended beyond those growth boundaries, it could encourage urbanization in rural areas and would be inconsistent with Vision 2020 and growth management.

2.6.5 Commuter Ferries

Puget Sound commuter ferries supplement the alternatives and will continue to do so. Commuter ferries have also been suggested to link east King County with Seattle and to provide north-south links along Puget Sound.

2.6.5.1 Commuter Ferries on Lake Washington

Moving people on passenger ferries could be an alternative to moving them in buses across the congested Lake Washington bridges. This option was studied in previous rapid transit planning efforts. A report to PSCOG (Madsen 1988) concluded that:

- o A high-speed passenger ferry system on Lake Washington is technically feasible; however, speed, noise, and wake controls could restrain the application of this technology.
- o Ferries could not compete with bus travel times and ferry patrons would have to transfer at each end of the ferry route. The travel time disadvantage occurs because ferry terminal sites could not be close enough to major centers.
- o Terminals, park-and-ride lots, and roadway improvements would be needed to support the ferry system, resulting in major traffic, noise, and wave erosion impacts on nearby communities.
- o Cost-effectiveness would be low because of high capital and operating costs shared among a limited ridership.

Lake Washington ferry service was therefore not considered in this DEIS.

2.6.5.2 Commuter Ferries Serving Tacoma, Seattle, Edmonds, and Everett

North-south regional mobility could be improved with ferry service along the east shore of Puget Sound. Such service is being studied by WSDOT and the JRPC and could supplement RTP's rapid transit proposals. However, except for Everett, downtown Seattle, and downtown Tacoma, major centers are not located on Puget Sound and would not be served. Existing ferry terminals also suffer from traffic congestion and poor arterial access. Expanded ferry service by itself would not be adequate for addressing the region's transit needs, but could provide supplemental service for the system (see Section 2.4.1.4).

2.6.6 Computer-Directed Non-Fixed Route System

During Metro 2000 scoping, suggestions were received to eliminate fixed bus routes and provide door-to-door demand-responsive service. In the most developed proposal (Metro 1991), riders would communicate their location and destination to a central computer, which would assign buses to take them to community transfer stations, from there to destination transfer stations, and finally to their actual destination.

While this proposal addresses the difficulties of serving the variety of trip types undertaken by the population, it lacks the ability to separate regional transit trips from congested arterials and freeways and provide them with congestion-free routes to their destinations. Transit vehicles would continue to lose time due to congestion, whether fixed route or not. Since the ability to attract riders is linked to speed and reliability, ridership would be relatively low.

In addition, computer-directed routing over an entire metropolitan area is an undeveloped technology. It is now used in limited area dial-a-ride service. It is unlikely that such a large system could be implemented without potentially significant cost overruns, programming errors, and access problems. On a smaller scale, this type of system will be used for transit services to passengers under the Americans with Disabilities Act. Such a system will be compatible with any of the alternatives and could be an integral component of TSM dial-a-ride service under all three build alternatives.

2.6.7 Major Extension of Electric Trolley System

This technology alternative would substitute electricity, an energy-efficient power source, for other bus fuels. Advantages would include reduced tailpipe emissions from the transit fleet, increased ability of the fleet to climb steep grades, and a potential for increased use of Metro's dual-mode bus fleet. The effects of using alternatively fueled buses, including trolley or electric buses, have been considered as part of all the alternatives in terms of energy usage and air quality. However, a major extension of the trolley system is not considered in detail for this EIS for two reasons. First, by itself this technology does not address the System Plan objectives of increasing regional mobility, removing transit from congestion caused by general-purpose traffic, and concentrating growth. Second, express bus service using an electric trolley system may run into technological and design limitations. The Seattle trolley buses and supporting overhead electrical distribution system, like most trolley bus systems, are designed for maximum speeds of 40 mph, which would be unsuitable for effective express bus service.

2.6.8 Alternative Rail Technologies

In this EIS, it is assumed that a rail system would operate like new systems in other cities, including San Diego, Portland, and Vancouver, B.C., and that it would have similar impacts. This technology has been used extensively and its advantages and disadvantages are apparent. Other possible technologies, such as monorail, maglev, or terrafoil (see Glossary), have not been used on a city-wide basis for intraurban transportation and have not been tested on operational issues such as switching, crossing lines, and carrying large passenger loads between urban stations (PBQD 1991j,k). In addition, some of the proposed rail system's facilities, including the Downtown Seattle

Transit Tunnel and the I-90 floating bridge, were specifically designed to accommodate a conventional rapid rail system. Other technologies would be more difficult or impossible to accommodate (Gannett-DeLeuw 1990). Adverse impacts of a different rail technology would likely be similar to or worse than those of conventional rail. If a different type of technology is chosen, potential differences in its environmental impacts would be considered in subsequent environmental review.

2.6.9 Phasing

Specific phasing alternatives were not considered as a part of this FEIS. Phasing is discussed generically, in terms of the expected land use and traffic impacts at interim terminals, and in terms of the need to promote transit-friendly land use beyond the initial segments of a rapid transit system. However, specific phasing decisions, such as the initial segment or corridor for a rapid transit system, may not be made until after a System Plan alternative is selected. Proposed phasing will be reviewed as part of project-level environmental review.

2.7 Benefits and Disadvantages of Delaying Action

Delaying action would have few environmental or procedural benefits. The need for transportation improvements already exists. Traffic congestion, transit inefficiency, and air pollution problems will continue to worsen. There are clear disadvantages to delaying action. Disadvantages include:

- Available right-of-way and station and park-and-ride sites are disappearing. Regional development will reduce available land and increase project costs and displacement impacts.
- The lack of a competitive transit system encourages low-density, sprawling development that favors automobiles and is difficult to serve with public transit.
- New land-use plans are currently being written. Without coordination with transit planning, these plans are unlikely to thoroughly support regional transit.
- Federal funds are available to help pay for commuter rail and rapid transit. Delay could cause these funds to be allocated to other projects. Additional funds would require more Congressional action.
- Not doing anything will worsen air quality and traffic congestion and fail to support measures to reduce SOV trips and manage growth. Delaying major transit investments will limit the effectiveness of programs to manage transportation demand and reduce air pollution.

A possible benefit of delaying action on the System Plan is that many existing local plans do not give clear direction regarding preferred station and alignment locations for transit improvements and rapid transit service. The land-use and transportation policies that would increase employment and residential densities and encourage transit use are not yet in place in many

cases. While RTP is working for consistency between local land-use and transportation policies and plans and the regional transit proposals, it might be simpler if those policies were already in place. On the other hand, existing planning schedules allow for and encourage close interaction between land-use and transportation planning authorities to ensure full compliance with the Growth Management Act.

Similarly, WSDOT is currently studying increased ferry, highway, and intercity rail investments that could be linked to local transit service. Because those planning efforts are much less complete than the System Plan, delaying action could allow more coordination. However, as state plans solidify, System Plan elements can be adjusted to integrate the plans.

3.0 Affected Environment, Impacts and Mitigation Measures

This chapter considers the various elements of the affected environment in the study area, the impacts that the four alternatives would have on that environment, and ways in which potential impacts could be mitigated. Impacts and mitigation measures are considered, for the most part, at a regional level or as typical impacts and mitigation measures, as is appropriate for a nonproject-level document.

3.1 Earth

3.1.1 Affected Environment

3.1.1.1 General Geology

The central Puget Sound region lies in a glacially scoured basin between mountains to the east and the west. The landscape is a series of north-south-trending ridges separated by deep troughs occupied by marine waters, fresh-water lakes, and streams.

Most surface and shallow subsurface soils were deposited during the most recent glaciation. These deposits generally include, from oldest to youngest:

- lakebed sediments (silts and clays)
- deposits from glacial runoff (sands and gravels)
- glacial till (very dense mixture of gravel, sand, silt, and clay).

Relatively recent (less than 10,000 years old) stream deposits and artificial fill are also present in many places.

Steep slopes in the area are conducive to landslides. Unconsolidated lakebed deposits and peats are prone to settlement. Strong lateral stresses in hard silt and clay adversely affect construction of retaining walls and underground facilities. Underground facilities could also be adversely affected by the water-bearing sand and gravel.

3.1.1.2 Seismicity

Historically, the region has had relatively frequent earthquakes of low to moderate intensities. Potential earthquake effects include ground shaking, loss of soil strength leading to ground failure (liquefaction), lateral spreading, and landslides. Liquefaction occurs primarily in clean, loose, saturated

sands, and can cause substantial settlement. The distribution and thickness of glacially-consolidated sediments, unconsolidated stream and lake deposits, and filled land critically affect earthquake motions and ground failure.

The most probable major earthquakes in the central Puget Sound area are deep (30 to 40 miles) earthquakes with magnitudes of 6 to 7.7, likely to occur every 30 to 50 years. Other potential earthquakes include shallow earthquakes along the Pacific coast with magnitudes of 8 to 9, likely to occur at intervals of hundreds of years. Scientists have recently postulated a major "Seattle fault" in the region beginning near Winslow on Bainbridge Island and running under downtown Seattle easterly to near Fall City. The exact path of the fault or faults is unknown. Shallow (less than 10 miles deep) earthquakes along the fault could have magnitudes of 7 to 7.5, apparently occurring at intervals of thousands of years. The most recent earthquake on the fault occurred roughly 1,000 years ago.

3.1.1.3 Subsurface Conditions

Developed areas in the region are built largely on glacial deposits. Many of the industrial areas are built in river valleys or estuaries, consisting of recent stream deposits and fill materials. Large sections of downtown Seattle have been modified by excavating and filling. While most of the area has a great thickness of glacial sediment, there are sedimentary rocks outcrops in Rainier Valley and on Beacon Hill. Thus, geologic conditions include soft saturated clay to very dense till, as well as artificial fill and sedimentary rock.

North Corridor

Capitol Hill has clay and sand glacial deposits. Perched groundwater is likely in sand where it lies above clay. High ground water levels, locally under pressure, are likely in the University District. Landslides may occur within clay deposits along the I-5 alignment. Deposits of soft clays, silts, peat, and fill occur in low-lying areas near Northgate, the county line, Swamp Creek, and parts of Everett.

South Corridor

Rainier Valley has some fill overlying unconsolidated deposits. Outcrops of sedimentary rock are likely above the valley. Soils east of Boeing Field include fill overlying glacially consolidated deposits. Duwamish Valley soils have been modified with fill. Glacially consolidated deposits are found in the I-5/SR-99 corridor south of the Duwamish Valley to the Milton area, where peat and soft soils are found in depressions and creek bottoms. Soft soils and high groundwater levels are likely in the Duwamish, Green, Cedar, and Puyallup River valleys.

East Corridor

Mercer Slough includes soft peat, clay, and silt with groundwater at or near the surface. Groundwater is also likely close to the surface along Interstate 405 in Bellevue. Deposits of soft soils are likely along May Creek. Along the I-90 corridor, soft surface soils are found near Lake Sammamish and the forks and tributaries of Issaquah Creek. Sedimentary rock outcrops are also found on the south side of I-90 west of Issaquah.

The geology along the I-405 corridor primarily consists of dense, glacially consolidated till and sand. Low lying areas near creeks and rivers include soft deposits of peat, clay, and silt, as well as unconsolidated sand deposits. Artificial fill is also likely to be present in low-lying areas. An outcrop of igneous rock is present along I-405 just west of the area where it crosses the Green River.

3.1.2 Construction Impacts

The magnitude of construction impacts would be greatest for the Rail/TSM Alternative, since it involves extensive tunneling and excavation. Construction impacts would be much less for the TSM and Transitway/TSM Alternatives. No significant impacts are expected under the No-Build Alternative.

Construction vibration may affect structures, depending on construction and soil types, method of excavation, and distance to structures. Surface settlement would be localized. Settlement would be of particular concern near large structures and in sand and gravel, fill, and lake and stream deposits. Loss of soil into tunnels may also cause surface settlement, particularly in water-bearing deposits. Subsurface settlement is more likely over deposits of soft clays and silts, peat, and fill.

Groundwater, particularly under pressure, will affect construction, requiring dewatering during construction of underground facilities, which could also cause settlement of adjacent property. Special tunneling techniques will be required where groundwater is present. Appropriate design features will be needed to permanently drain underground facilities while minimizing the effect on adjacent property.

Special construction procedures will be required where sedimentary rock is found. Excavation may require blasting, which could have noise, vibration, and safety impacts.

Commuter Rail Element

Significant amounts of excavation are not expected for this alignment, although station and park-and-ride construction would require some excavation and earth impacts.

3.1.3 Operations Impacts

Transit operations can be affected by earthquakes. Most soils in the region are glacially overconsolidated and as such are not susceptible to vibration-induced settlement. However, each corridor includes soils prone to liquefaction, particularly fill soils, tidal flats, and other unconsolidated deposits. Ground vibration could cause settlement in unconsolidated soils.

North-south RTP rapid transit alignments would cross the recently postulated "Seattle fault." Since the exact location of the fault is unknown, the potential crossing points cannot be precisely determined.

At-grade transit operations, whether consisting of trains operating on rails or buses operating on pavement, would likely experience the same types of damage that would occur to highways during a significant earthquake. In general, temporary repairs to at-grade pavement could be accomplished quickly. In addition, buses could be detoured past damaged areas. Repairs

to rail require special equipment, and it would likely require more time to place a rail system back into operation. The costs of repairs to either type of surface transit infrastructure would likely be similar in magnitude.

Above-grade structures, whether elevated train platforms, busways, or bridges, are designed to withstand shaking from specific magnitude earthquakes. However, they cannot be designed to withstand the displacement that could occur directly over a fault.

Below-grade facilities would also be designed to withstand a certain amount of ground shaking. In addition, tunnels can be designed to withstand a certain amount of ground displacement along a fault through the use of "crushable backpacking" surrounding the tunnel lining. This concept has been utilized in constructing tunnels through known fault zones in California. It could not be used along the "Seattle fault" in the absence of much more specific information regarding the fault's location.

The design of any new RTP facilities (or renovation and upgrading of existing facilities to accommodate regional transit operations) would be comply with all applicable building codes and current or updated seismic code requirements. RTP facilities would be more likely to survive earthquake impacts than existing transportation infrastructure, which was built to less stringent seismic standards.

Commuter Rail Element

As noted above, operation of the line could be affected by earthquakes. Repair and resumption of commuter rail operations disrupted by earthquake damage would tend to require more time than repair and resumption of operations of at-grade bus facilities, but costs would probably be of the same order of magnitude.

3.1.4 Mitigation of Impacts

Anticipated geologic concerns may be avoided by adjusting alignments. Where alignments cannot be changed, potential problem areas will be identified and mitigated in design and construction. Facilities will meet applicable state and local codes for safety during earthquakes. In addition, facilities will be designed to avoid worsening potential seismic effects on adjacent property or structures and to counteract potential liquefaction through ground densification, dewatering, or alternate means of support.

The potential impacts of surface settlement, subsurface settlement, and other ground movements will be minimized by ground modification (grouting, freezing, removal of unsuitable materials) and structural modification (deep foundations, underpinning, spanning deposits). Potential ground movements will be monitored during construction. Adequate support to adjacent structures will be provided during construction.

3.2 Air Quality

The data included in this analysis of air quality trends and impacts has been refined in response to public and agency comments. In addition, various corrections have been made since issuance of the DEIS. All of the text,

tables, and figures have been updated to reflect the corrected data. None of the corrections or changes significantly affect the analysis or conclusions.

3.2.1 Affected Environment

3.2.1.1 Policy Setting

Despite progress over the last decade in controlling emissions from large industrial sources and automobiles, ambient air pollution (pollution of outdoor air) continues to be a serious environmental threat in the state and local region. In 1989, the Washington State Environment 2010 project identified ambient air pollution as the number one threat to the environment (State of the Environment Report 1989). The City of Seattle recently ranked transportation sources of air pollution as the City's top environmental challenge in terms of both relative risk and overall priority for action (City of Seattle 1991).

Air Pollutants of Concern

Criteria Pollutants. The federal Clean Air Act established national ambient air quality standards (NAAQS) for six criteria air pollutants: carbon monoxide (CO), ozone (O_3), particulate matter, nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and lead (Pb). See Section 3.7.1.3 for health effects of these pollutants.

Carbon monoxide (CO) is a deadly gas formed from incomplete combustion of carbon-containing fuels. Motor vehicles are the principal source of carbon monoxide emissions within the metropolitan region.

Ozone (O_3) forms in the lower atmosphere from the reaction of hydrocarbons (HC) and oxides of nitrogen (NO_x) in the presence of sunlight. Hence its precursors, HC and NO_x, are the emitted pollutants of concern. Various polluting hydrocarbon compounds are emitted or evaporate into the air in connection with the use and combustion of fuels in motor vehicles.

The *particulate matter* of concern consists of two classes: total suspended particulates (TSP) and inhalable TSP that is made up of particles 10 microns or less in diameter (PM_{10}). Particulate matter enters the air from industrial operations, vehicular traffic, and other fuel combustion sources, including wood stoves. Most of the PM_{10} generated by motor vehicles consists of resuspended road dust. In addition to adverse health effects, suspended particulates contribute to the soiling of buildings and reduced visibility.

Nitrogen dioxide (NO_2) forms as the result of high-temperature fuel combustion and subsequent atmospheric reactions. In addition to health effects, it reacts with moisture to form acid mist or rain.

Sulfur dioxide (SO_2), a colorless corrosive gas, is produced by industrial processes and the combustion of sulfur-containing fuels, including coal, oil, and diesel fuel. In addition to health effects, SO_2 damages the foliage of trees and agricultural crops and contributes to the formation of acid rain.

Since the introduction of unleaded gasoline, *lead* is no longer a tailpipe emission of significant concern.

$\underline{CO_2}$. Although not a criteria pollutant, or even generally conceived as a pollutant, carbon dioxide (CO_2), a major by-product of burning fossil fuels, is a growing concern because of its contribution to global warming.

Toxic Air Pollutants. Principal transportation-related toxic air pollutants, for which data are extremely limited, include benzene, formaldehyde, gasoline vapors, and diesel particulates. Mobile source emissions are extremely complex. Hundreds of compounds are associated with both the gas phase and particulate components of emissions. The levels of potential health risk associated with various toxic air pollutants are highly variable.

Toxic air pollutants have been associated with increased cancer risk. Toxic air contaminants overlap other categories of pollutants including total suspended particulates, PM10, and hydrocarbons.

Ambient Air Quality Standards and Nonattainment Areas

Ambient air quality standards identify pollutant concentrations that are not to be exceeded over specified periods. Primary standards protect public health. Secondary standards protect the natural environment. Under the federal Clean Air Act, areas that violate primary standards are designated "nonattainment areas" and State Implementation Plans (SIPs) must be developed to bring these areas into attainment. SIPs generally include transportation control measures to reduce motor vehicle emissions.

Clean Air Act Amendments of 1990

The federal Clean Air Act Amendments (CAAA) of 1990 reflect a national commitment to attain air quality standards. As a result, attainment of ambient air quality standards is now a critical objective in making urban transportation investment decisions. The 1990 CAAA requires establishing objectives for emission reductions within nonattainment areas, updating emissions inventories in revised SIPs, forecasting vehicle miles traveled (VMT), and developing contingency measures to put into effect if air quality standards or VMT forecasts are exceeded.

The 1990 CAAA requires the PSRC to determine the effect on air quality of any proposed transportation plan, program, or project. More specifically, the PSRC is responsible for ensuring that new transportation plans, programs, and projects will not:

- cause or contribute to violations of air quality standards
- increase the frequency or severity of existing air quality problems
- delay attainment of air quality standards.

The PSRC, as the Metropolitan Planning Organization (MPO), also prepares of Transportation Improvement Programs (TIPs) for the central Puget Sound region. The TIP is a six year regional plan for transportation projects, specifying project timing, costs, funding sources and priorities. Eligibility of projects for federal funding is dependent on inclusion in the TIP and a finding (by the PSRC and the Federal Highway Administration) that the TIP conforms with air quality and congestion management objectives. In 1991, the PSRC found that both the Vision 2020 plan and the 1992 TIP conform to the federal Clean Air Act and the Washington SIP. This finding was approved by the U.S. Department of Transportation. In 1992, PSRC staff also found that the Rail/TSM Alternative would support the Vision 2020

plan better than the other alternatives (see first volume of comments and responses) and could help to achieve its objectives, including:

- limiting the spread of urban development
- concentrating growth in centers
- improving connections between land use activities
- enhancing the competitiveness of transit
- protecting environmental resources.

After a Final System Plan is adopted by the JRPC, the PSRC Transportation Policy Board and Executive Board will issue a conformity finding.

Federal and State Clean Air Acts and Washington State Implementation Plan (SIP)

Under the federal Clean Air Act, states which violate national ambient air quality standards must adopt a SIP for attaining the standards and to submit this plan to the U.S. EPA for approval. The Puget Sound region must attain carbon monoxide (CO) standards by December 31, 1995 and ozone (O3) standards by November 15, 1993. Prior to any formal redesignation of the local nonattainment areas as attainment areas, the state must also adopt a 10-year maintenance plan and submit it to the U.S. EPA for approval. Failure to submit an acceptable SIP may result in sanctions that include withholding federal highway and mass transit funding.

The federal and state clean air acts require all transportation plans, programs, and projects to conform with the SIP. Preparation of the SIP is the responsibility of the Washington State Department of Ecology (DOE), in cooperation with the PSRC and the Puget Sound Air Pollution Control Agency (PSAPCA). The DOE also administers state programs that are important to maintaining air quality in the nonattainment area, including the oxygenated fuel program, SIP conformity determinations, and vehicle inspection and maintenance (I/M) program.

Drafts of the SIPs for carbon monoxide and ozone were published by DOE in November and December, 1992. The final SIPs will include new state conformity regulations (Chapter 173-420 WAC), which were adopted in January 1993. These regulations establish process based on existing requirements of the Clean Air Act, the Intermodal Surface Transportation Efficiency Act (ISTEA), the State Growth Management Act (GMA) and the State and National Environmental Policy Acts (SEPA and NEPA). In this process, conformity occurs primarily at the regional level through the PSRC, acting as the MPO in cooperation with local units of government, the PSAPCA, the DOE, the Washington State Department of Transportation, the EPA, and the United States Department of Transportation. A wide range of transportation control measures (TCMs) may be included in SIP supplements and subsequent maintenance plans to further reduce motor vehicle emissions.

Commute Trip Reduction Law

The 1991 Washington State legislature enacted a law to improve air quality, reduce traffic congestion, and decrease the consumption of petroleum fuels. The law requires employer-based programs that encourage alternatives to SOVs for commuting to the workplace. The law applies to employers with

100 or more full time employees in a single location who begin the work day between 6:00 a.m. and 9:00 a.m. in counties with populations of greater than 150,000. Although no specific requirements are placed on transit providers, improved transit service will help employers meet the mandates under the law. These mandates include a reduction in single occupant commute trips of 15 percent in 1993, 25 percent by 1997, and 35 percent by 1999.

3.2.1.2 Historical and Existing Air Quality Conditions

The Puget Sound region currently meets federal standards for lead, sulfur dioxide, and nitrogen oxides, but portions of the region exceed standards for carbon monoxide, particulate matter, and ozone. Motor vehicle tailpipe emissions are primary sources of carbon monoxide and ozone. Tailpipe emissions and resuspended road dust contribute to suspended particulates.

Carbon Monoxide (CO)

Within the Puget Sound region, motor vehicles contribute roughly 70 to 75 percent of carbon monoxide emissions. Carbon monoxide's impact is usually very localized. Highest concentrations often occur near congested roadways and intersections. Violations of carbon monoxide standards within the region have decreased since the early 1970s, due to replacement of older "dirtier" vehicles with newer cars that comply with more stringent emission standards. A multi-year summary of CO levels is shown in Figure 3.1. The state's I/M program has also contributed to lower CO emissions.

In 1987 and 1988, downtown Bellevue, Everett, Seattle, and Tacoma, and the University District were nonattainment areas for CO. Seattle met the CO standard in 1989 and in 1990 Bellevue, Tacoma, and the University District also met the standard. In 1991, CO concentrations exceeded the 8-hour standard in Tacoma and Everett, and came close to exceeding it in the University District, Northgate, and downtown Seattle. In 1992, in response to the 1990 CAAA requirements, Ecology consolidated these localized CO nonattainment areas into a single regional nonattainment area that extends along the I-5 corridor from Marysville to south Pierce County.

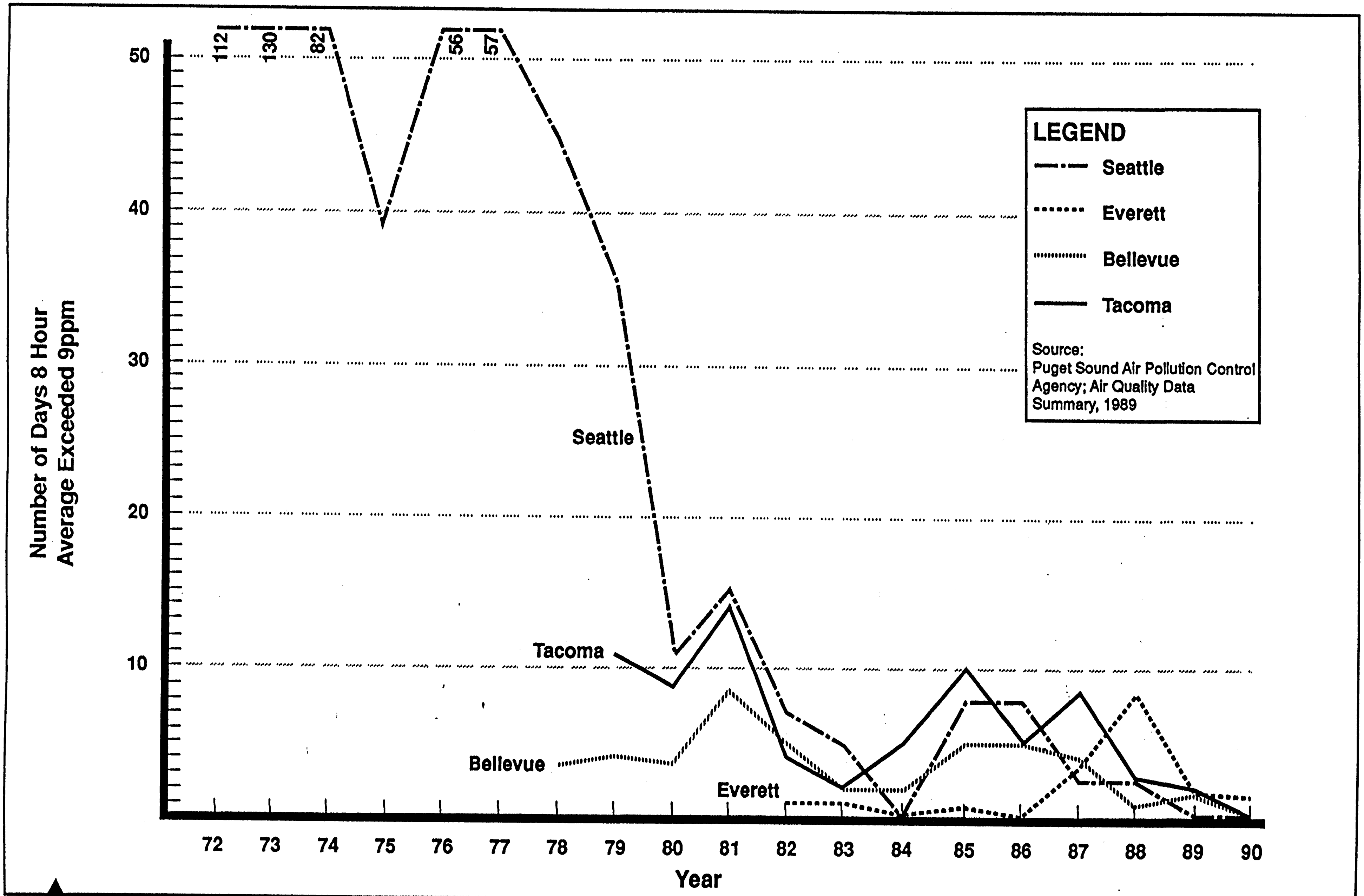
Ozone (O3)

Ozone results from sunlight-driven chemical reactions in the air between nitrogen oxides and hydrocarbons. The highest levels of ozone tend to occur on hot afternoons when urban area emissions trapped beneath temperature inversions are exposed to high temperatures. Because northerly winds often develop during these days, the highest ozone levels tend to occur south to southeast of the major urban areas where precursor emissions occur. Hence high ozone levels tend to be more of a regional than a localized concern.

EPA designated the Puget Sound region as "in attainment" of the O3 standard in January 1987, based on measured concentrations over a three-year averaging period. This designation continued until 1990, when the standard was exceeded at three monitoring sites. In 1992, the EPA designated the three-county region as a "marginal" nonattainment area for ozone. The vehicle emission testing program is being expanded throughout the Puget Sound area to help bring the region back into compliance.

Total Suspended Particulates (TSP) and PM10

Industrial areas in Seattle and Tacoma have consistently violated the State and regional standard for TSP. Motor vehicles contribute roughly 80 percent



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Carbon Monoxide Levels - Multi-Year Summary

System Plan EIS

FIGURE 3.1

of TSP emissions. Within King County, PM10 constitutes about 40 percent of total on-road suspended particulates. At least 50 percent of on-road PM10 consists of resuspended road dust, with the remainder deriving from vehicle exhaust and dust from vehicle brake and tire wear. Three Puget Sound PM10 nonattainment areas (Seattle, Kent, and Tacoma) have been designated, although recent monitoring indicates compliance with standards. PM10 concentrations have been monitored in the region since 1983. The region has generally been in compliance with the annual PM10 standard and has only had isolated instances where the one day value was exceeded. Within the last several years, two locations within the port area of Tacoma have barely exceeded the 24 hour average PM10 standard. Between 1987 and 1989, neither Seattle nor Tacoma attained State and regional TSP standards, but both attained federal, State and regional PM10 standards. More recent data indicate a similar pattern.

Sulfur Dioxide (SO_2)

Washington State and Puget Sound annual and 24-hour average standards for SO_2 are more rigorous than federal standards. Historical data (1987 through 1990) show no violations of the three annual standards, but indicate violations of State and regional one-hour and five-minute standards in 1987.

3.2.1.3 Long Term Trends

Air Quality

The dramatic improvements in air quality that occurred in the 1980s were attributable to several factors:

- strong public environmental awareness and consensus for regulatory and political change during the 1960s and 1970s
- the availability of effective, relatively inexpensive technological improvements for automobile emission control systems
- the introduction of light-weight durable materials to replace steel, which allowed cars to become lighter and more fuel-efficient
- the increased cost and limited supply of gasoline due to the Middle East oil embargo of the 1970s
- economic prosperity during the 1980s, which helped replace many old cars without emission control systems.

The following trends work against improvements in the levels of motor vehicle emissions in the Puget Sound region:

- Economic recession during the 1990s has slowed the introduction of newer cars into the vehicle fleet.
- VMT is projected to increase by 78% by 2020.
- The arterial transportation system is mature, with no planned significant increase in roadway capacity.
- Increased congestion and travel delay and slower travel speeds are expected.
- In the absence of significant policy changes, average vehicle emission rates are expected to stabilize around 2005.

On the other hand, many factors point to the possibility of future legislation which could lead to increased use of low or zero emissions motor vehicles, which would considerably reduce aggregate motor vehicle emissions.

Global Warming

The burning of fossil fuel in motor vehicles contributes to the production of carbon dioxide which contributes to potential global warming. Although increased transit use may modestly reduce motor vehicle use, the heavy use of automobiles for personal transportation needs is expected to continue. Hence, significant reductions of motor vehicle carbon dioxide emissions will depend on significant introduction and use of motor vehicle technologies which substantially reduce carbon dioxide emissions.

3.2.1.4 Transportation and Air Quality

Motor vehicles currently generate roughly 80 percent of all particulate emissions within the region, 70 to 75 percent of carbon monoxide emissions, 60 percent of nitrogen oxide emissions, and 25 percent of hydrocarbon emissions (Figure 3.2), although these proportions have changed. Motor vehicle emissions continue to be of concern, since levels of carbon monoxide, ozone, and fine particulate matter have approached or exceeded National Ambient Air Quality Standards in recent years and the growth of regional vehicle miles of travel could worsen regional motor vehicle emissions.

Mode Choice

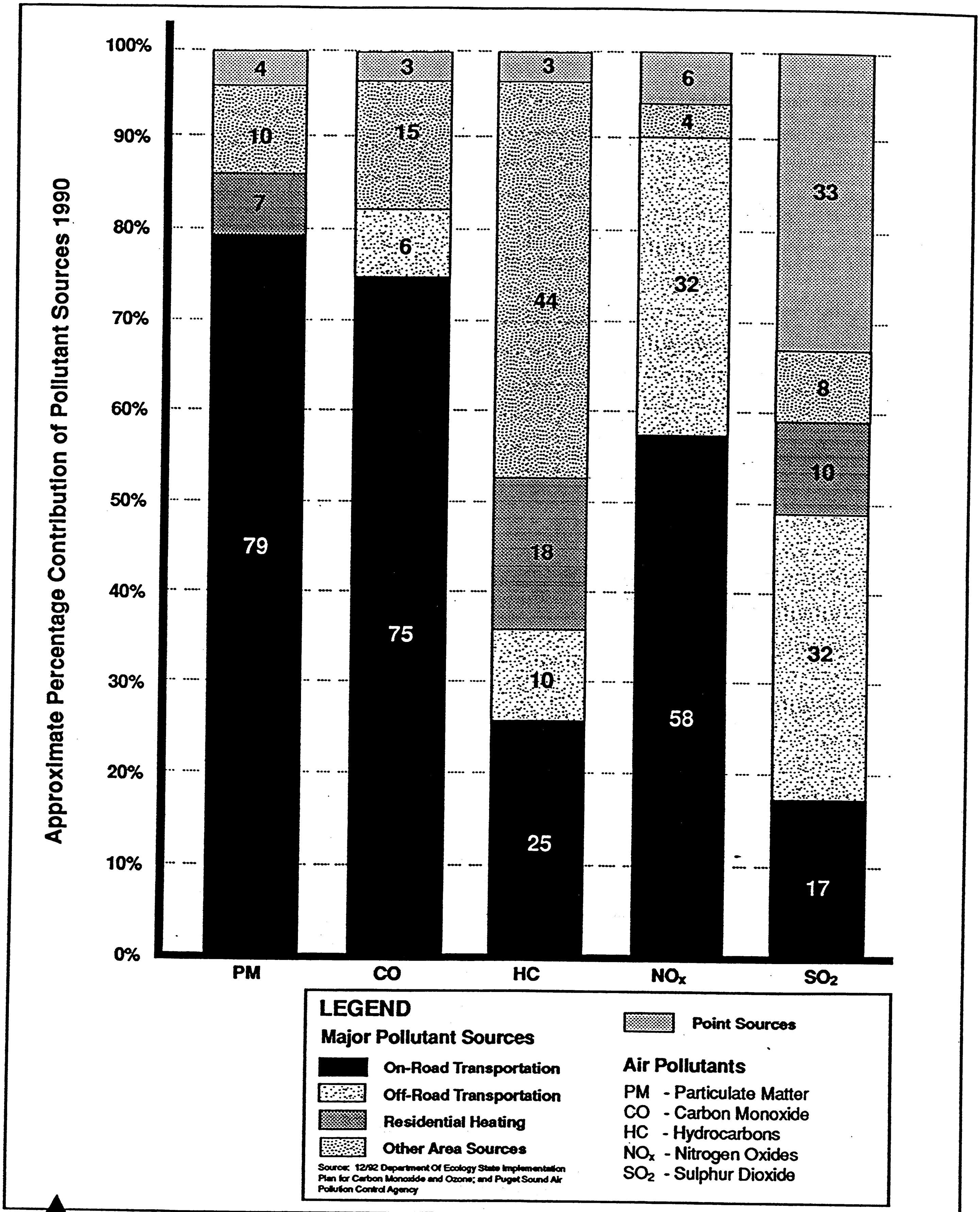
With current motor vehicle emission characteristics, individual mode choices (walking, bicycling, driving in an SOV, or riding in a carpool or on a bus) substantially affect individual contributions to aggregate motor vehicle emissions. Walking, bicycling, or use of HOVs reduce vehicle miles of travel and emissions per passenger mile of vehicular travel.

Vehicle Occupancies

Vehicle occupancy rates have a major impact on per-passenger-mile pollutant emissions and energy efficiencies of different transportation modes. Thus, it is important to consider the characteristic passenger loads associated with different modes. Figures 3.3 and 3.4 illustrate the per-passenger-mile emissions of carbon monoxide, nitrogen oxides, hydrocarbons, and particulate emissions for commuter rail trains, buses, and cars operated as SOVs or three-person carpools.

Average transit vehicle passenger loads are generally considerably less than their capacities, due to their moderate to low ridership during nonpeak service hours and "deadhead" miles (non-revenue miles traveled without passengers between routes and operating bases). The basic pattern of many transit routes, where passengers are picked up at stops toward one end of the route and disembark at a series of stops toward the other end of the route, also contributes to reduced overall passengers loads.

Average bus passenger loads were estimated using Metro fleet data. The average passenger load per mile for Metro's 1990 fleet (total annual passenger miles divided by total annual vehicle miles, including deadhead miles) was 11.2 people (14.1 for the electric trolley fleet and 11.0 for the diesel bus fleet). Metro's deadhead miles constitute about 25 percent of its total transit vehicle miles and are equivalent to about 33 percent of revenue miles (USDOT/FTA Data Tables for the 1990 Section 15 Report Year, December, 1992).



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Summary of Air Pollutant Sources, Puget Sound Region

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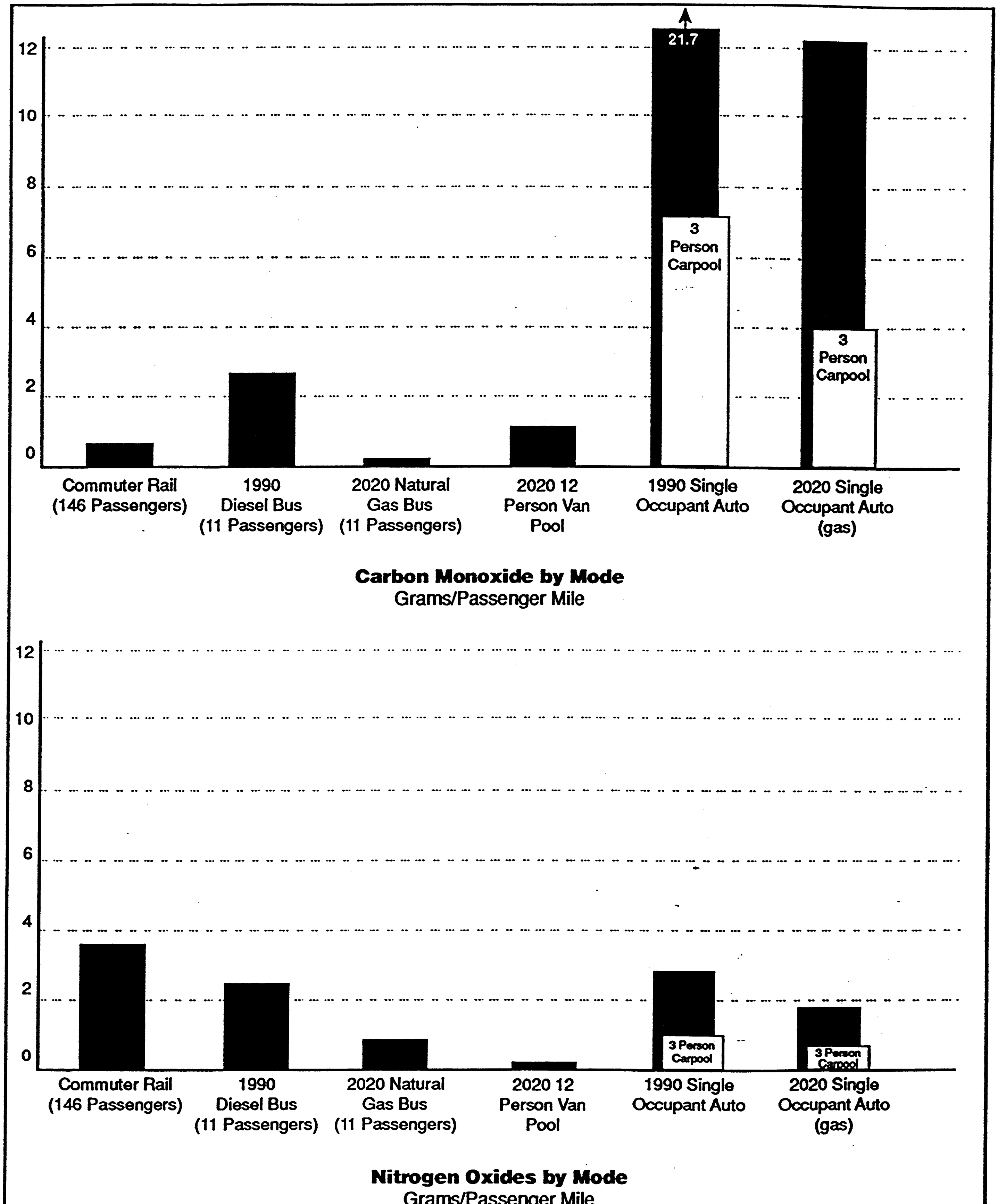
FIGURE 3.2



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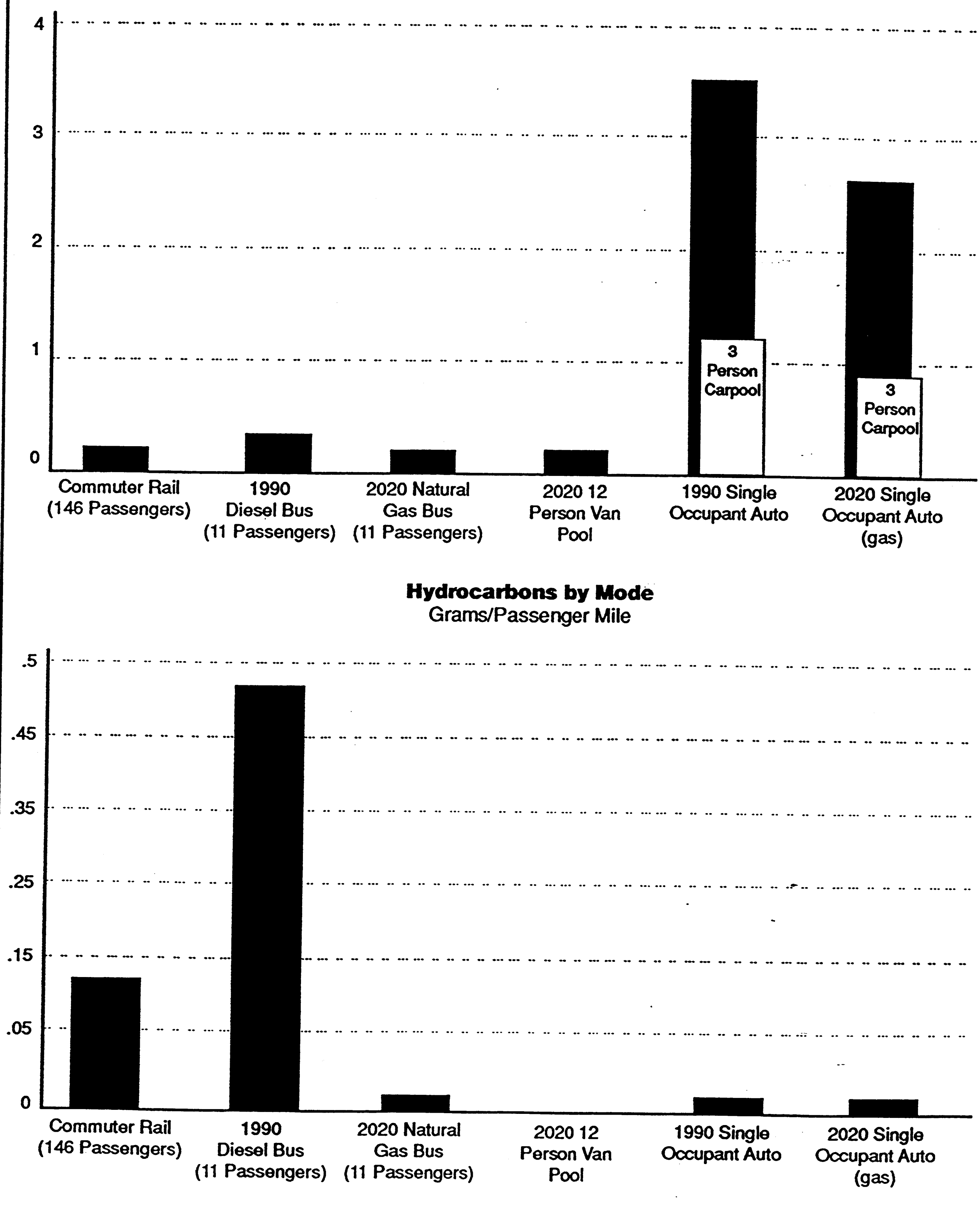
Estimated Air Pollutant Production Per Passenger Mile

System Plan EIS

FIGURE 3.3



Particulate Matter by Mode
Grams/Passenger Mile

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Estimated Air Pollutant Production Per Passenger Mile

System Plan EIS

FIGURE 3.4

Average passenger loads of different types of transit vehicles vary considerably. All carry considerably greater average passenger loads than the average passenger car. Average bus passenger load (with off-peak service hours and deadhead mileage factored in) is generally an order of magnitude (10 times) greater than that of passenger cars.

It is conservatively estimated that the rapid rail cars recommended in the Rail/TSM Alternative would have an average overall occupancy of 24 passengers, twice the average occupancy of buses. Commuter rail trains would average 146 passengers, an order of magnitude greater than average bus occupancy. The high average passenger loads of rapid rail vehicles and commuter rail trains results not only from their greater passenger capacities, but from longer average ride lengths, the application of rail service to areas and routes that have the highest service demand, and the ability of rail vehicles to make more round trips during peak periods.

The per-passenger-mile emissions of passenger cars depends on the different transportation mode functions they play. Operated with only a driver, cars are single occupant vehicles (SOVs). Operated with 2 or more passengers they are carpools or high occupancy vehicle (HOV). Since average passenger car occupancy rates are a statistical abstraction encompassing both SOVs and HOVs, the FEIS compares average per-passenger-mile emission and energy consumption characteristics of HOV transportation modes with those of SOVs rather than the average overall occupancy rate of passenger cars, but uses the average rate when computing total vehicle emissions and energy use.

Both peak and average performance of transit vehicles are important when comparing their emissions and energy efficiency to low occupancy vehicles (LOVs). During peak travel periods, peak passenger loads on many transit vehicles approach or exceed seat capacities. However, even during peak periods, the number of transit passengers varies on and between routes. Average bus passenger loads during the 3-hour morning and afternoon peaks are generally at least two to three times greater than average daily loads (Line, 1993; Beal, 1993). Average peak commuter rail train loads are expected to be at least 60 percent greater than average daily loads (Line, 1993; Beal, 1993). Hence, peak period bus emissions per passenger mile is about 50 to 67 percent less than the overall average levels shown in Figures 3.3 and 3.4. Average peak period emissions per passenger mile for commuter rail are expected to be 35 to 40 percent lower than the average levels shown in Figures 3.3 and 3.4.

During peak travel periods, the contribution of low-occupancy-vehicle (LOV) modes to aggregate motor vehicle emissions is the greatest, due to the high volumes of LOV passenger miles and the adverse effects of traffic congestion. Traffic congestion will cause the peak period per-passenger-mile emission rates of LOVs to be significantly higher than the rates shown in Figures 3.3 and 3.4. The per-vehicle-mile emission rates of transit vehicles also deteriorate during peak traffic periods, but the effect on average emissions per passenger mile is lessened due to the larger passenger loads. The larger passenger loads of transit vehicles result in transit vehicles generally having at least competitive and frequently much better pollutant emissions and energy efficiencies per passenger mile than LOVs.

Vehicle Emissions

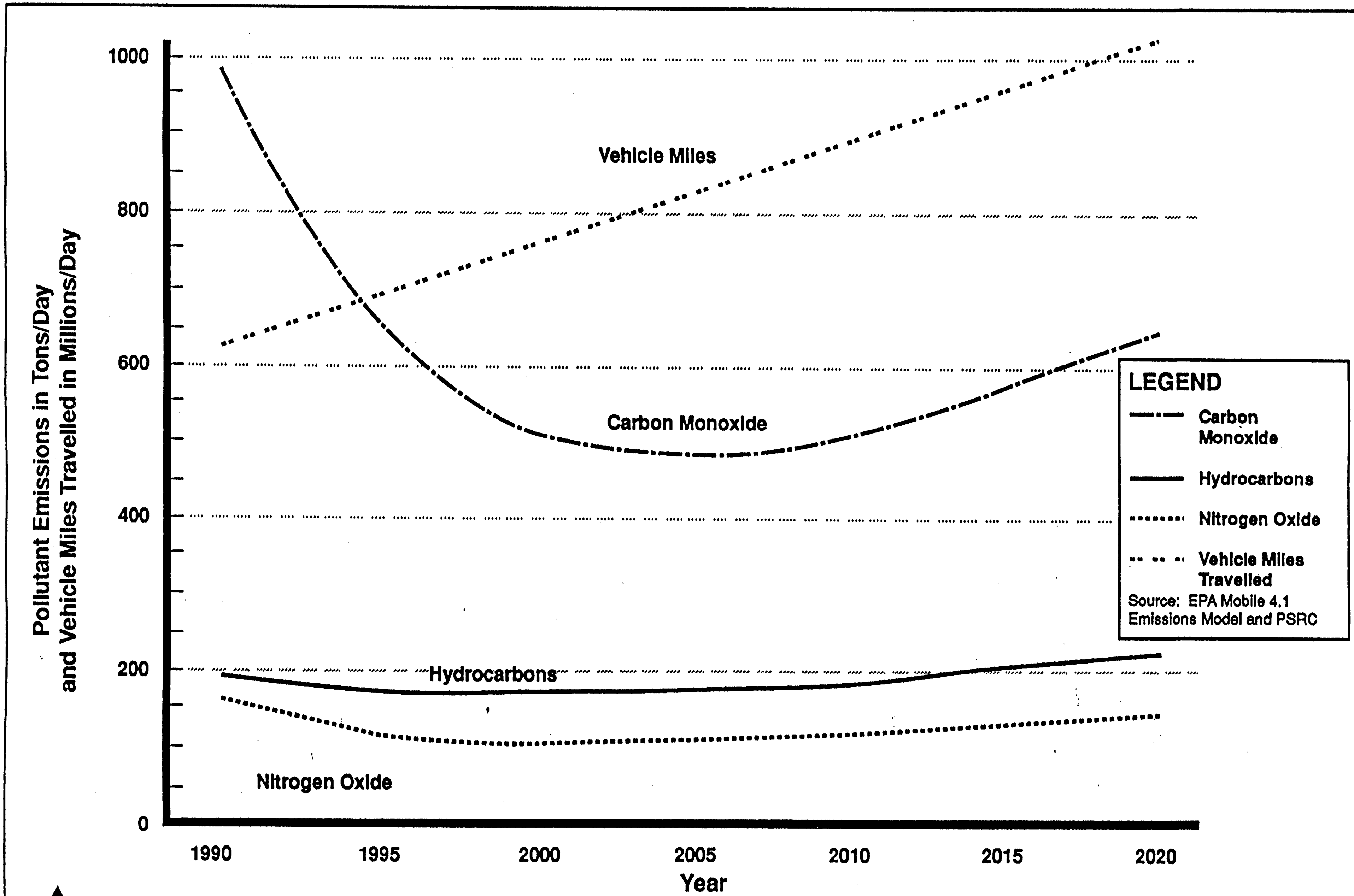
The emissions characteristics of transit vehicles and passenger cars are highly variable, due to different power sources (electric trolleys, diesel buses, dual-mode buses, gasoline-powered cars, diesel-powered cars, electric cars, etc.) and the ongoing impacts of regulatory changes and technological advances. A variety of factors could lead to adoption of more stringent vehicle emission restrictions or tougher fuel economy requirements, which could significantly alter technologies and emissions characteristics of both transit vehicles and passenger cars. While it is reasonable to expect some of these improvements over the next thirty years, neither their timing or results are sufficiently assured to provide a sound basis for projecting different 2020 emissions characteristics for transit vehicles and passenger cars.

<u>Passenger Cars</u>. Over the last ten to fifteen years, increasingly stringent passenger car emissions standards have dramatically reduced motor vehicle emissions. As older cars continue to be replaced by newer cars, average motor vehicle emissions declined. Vehicle emission rates are expected to decline at a diminishing rate until about 2005. Thereafter, unless there are significant changes in regulations, average vehicle emissions are not expected to change significantly (EPA Mobile 4.1 Emissions Model). Projected increases in vehicle miles traveled within the central Puget Sound region (as projected by the PSRC) are expected to reverse the decline in aggregate motor vehicle emissions around 2005. Figure 3.5 illustrates the expected relationship over time between growing regional VMT and motor vehicle emissions of carbon monoxide, nitrogen oxides and hydrocarbons.

<u>Transit Vehicles</u>. On a per-vehicle-mile basis, buses (the vast majority of which have been diesel-powered) have typically generated a considerably greater amount of exhaust pollutants than automobiles. Diesel bus emissions have varied greatly as a result of wide variations in emissions characteristics of the range of bus diesel engines. Conventional diesel-powered buses have been notorious for odorous smoky emissions. The conventional diesel exhaust emissions have included substantially more particulates than the gasoline engine exhaust. Diesel particulate emissions include significant quantities of potentially hazardous very fine respirable particulates. Some of the compounds associated with diesel exhaust particulates (such as benzo(a)pyrene) are known carcinogens.

Nevertheless, aggregate regional transit fleet emissions represent less than one percent of aggregate motor vehicle emissions. Within King County, transit fleet carbon monoxide emissions are currently less than 0.2 percent of total motor vehicle carbon monoxide emissions during the winter season when carbon monoxide emissions tend to be highest (Booz-Allen & Hamilton, 1992). Stringent new emission standards applied to urban buses during and after the 1990s will help substantially reduce transit fleet emissions of nitrogen oxide and particulate matter. Diesel buses meeting the 1998 urban bus particulate emission standards will have no visible soot in their exhaust.

The 1990 vehicle emission rates in Figures 3.3 and 3.4 are based on estimated average emissions per mile for automobiles (based on MOBILE4.1 generated data) and estimated average (1990) regional diesel bus emissions. The assumed 2020 emission rates for both buses and passenger cars are based on implementation of currently adopted emission standards, including



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Aggregate Vehicle Fleet Air Pollutant Emissions and Vehicle Miles Travelled by Year

System Plan EIS

FIGURE 3.5

strict urban bus emission standards. Estimated passenger car emissions for 2020 have been estimated to be equivalent to those of gasoline-powered passenger cars meeting current adopted emissions standards and reflect only the changes expected as older cars are replaced with newer cars meeting current emissions standards. Projected commuter rail emissions are based on the current unregulated diesel technology of commuter rail trains. Cleaner technologies may become available within the time horizon of the RTP, but cannot be assured.

Figures 3.3, 3.4, and 3.11 highlight the impact specific technologies used in transit vehicles on their emissions and energy efficiency relative to those of LOVs. Electric transit vehicles are not included in the figures because they do not produce exhaust emissions. As the figures illustrate, natural gas buses produce substantially lower carbon monoxide, nitrogen oxide, and particulate emissions than today's diesel bus fleet. Even the 1990 diesel bus fleet produces significantly lower carbon monoxide and hydrocarbon emissions per passenger mile than low occupancy gasoline-powered motor vehicles.

Vehicle Operating Characteristics

Temperature, altitude, vehicle load, and speed also affect exhaust emissions. Exhaust emissions per mile are worst when vehicles are idling, generally diminish up to speeds of about 45 to 50 mph, and then generally increase at higher speeds. Figure 3.6 illustrates the relationship between vehicle speeds and emissions per mile of principal exhaust pollutants.

Average vehicle operating speeds can play a significant role in altering the rates of traffic-generated exhaust emissions. Traffic congestion, leading to delays and reduced speeds, can significantly elevate exhaust emission rates per vehicle mile and contribute to localized carbon monoxide "hotspots."

Before their engines reach normal operating temperatures, motor vehicles produce up to 30 times their normal emissions per mile. These emissions are know as "cold-start" emissions. Unlinked short vehicle trips contribute disproportionately to increased motor vehicle emissions.

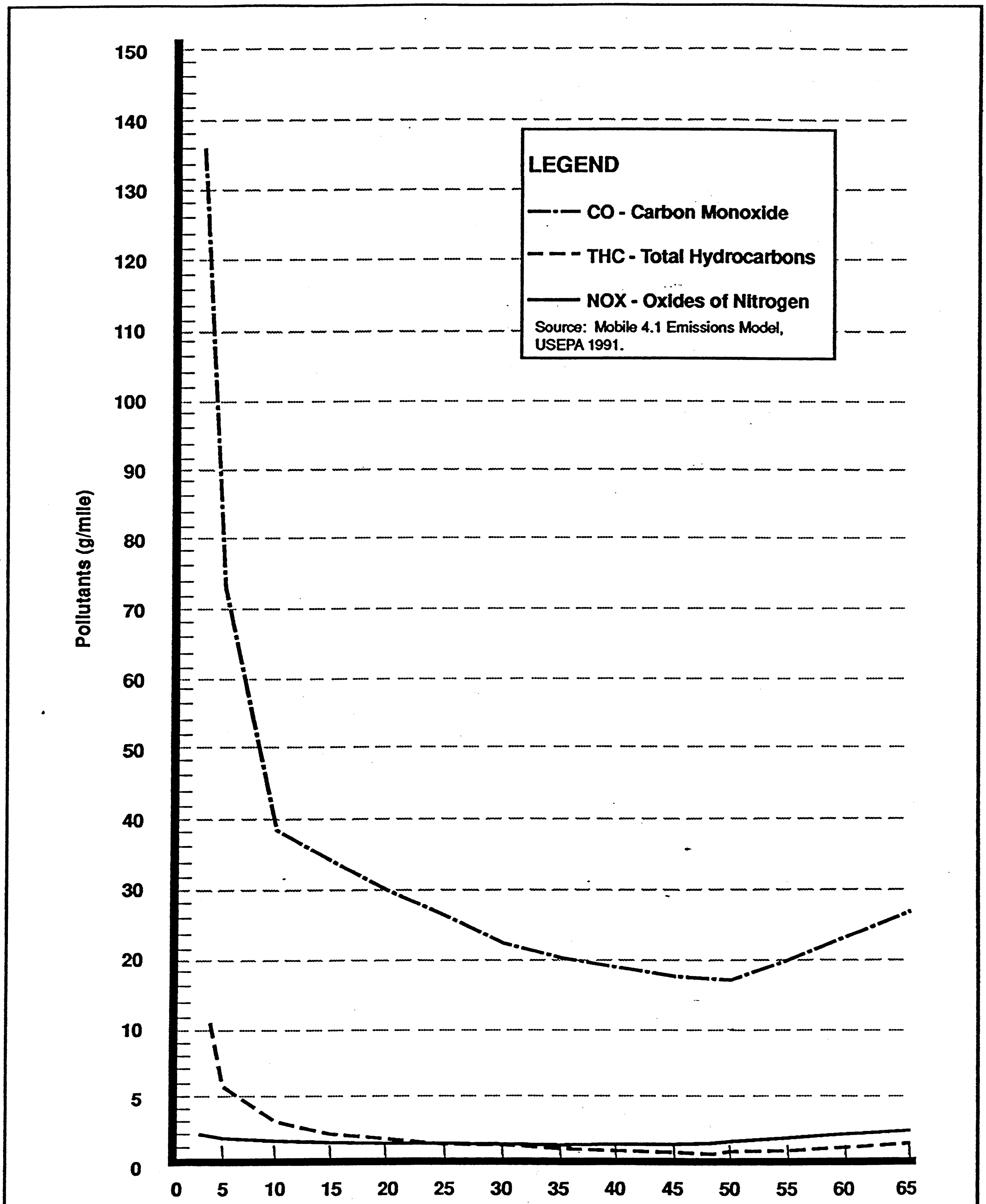
3.2.2 Construction Impacts

Construction could likely to generate localized dust and exhaust emissions from vehicles and equipment. Construction within existing roadways could contribute to localized traffic congestion, worsening local exhaust emissions. Increased exhaust emissions from slower general purpose traffic is likely to have a greater impact on localized air quality than exhaust emissions from construction equipment.

The quantities of directly generated construction dust and exhaust emissions will depend on the amount of clearing, grading, and excavating associated with each alternative. Trucks and other vehicles driven to and from sites may also track mud along access routes, potentially contributing to dust problems. PSAPCA regulations require that the best available control technology be used to control fugitive dust emissions.

3.2.2.1 No-Build Alternative

There would be air quality impacts from the No-Build Alternative from construction of committed projects and infrastructure maintenance projects. Impacts would be minimal.



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Tailpipe Pollutant Emissions Relationship to Vehicle Speed

System Plan EIS

FIGURE 3.6

3.2.2.2 TSM Alternative

The expansion of HOV and park-and-ride systems would result in construction-related CO and dust emissions. Construction could also cause lane restrictions and temporary closures that would increase congestion-related emissions of CO.

3.2.2.3 Transitway/TSM Alternative

Construction air quality impacts would be more extensive than the TSM Alternative, but not as extensive as the Rail/TSM Alternative. Construction of a two-way transitway on major freeways would cause increased CO emissions due to traffic slow-downs and delays and increased particulates from grading, excavation, and materials handling. Development of the transitway on I-5 reversible lanes could require temporary lane closures along I-5, resulting in increased traffic congestion and exhaust emissions.

3.2.2.4 Rail/TSM Alternative

The Rail/TSM Alternative would include extensive construction below ground, at ground level, and above grade.

Building the fixed guideway and stations for the rail system would involve the greatest amount of construction, excavation, and movement of soils. Removing and disposing of tunnel spoils and placing road bed ballast may contribute to significant dust emissions at construction and construction staging sites. Tunnel and subway construction would result in relatively high concentrations of equipment exhaust emissions near tunnel portals and cut-and-cover subway stations.

Construction of the I-5 rail alignment in the North Corridor could potentially cause moderate to severe air quality impacts during some phases. Use of the I-5 bridge for rail operations would require extensive upgrading of the bridge and could require temporary lane closures, substantially reducing bridge capacity. Significant lane closures would lead to substantial traffic congestion, contributing to elevated air pollutant emissions.

Commuter Rail Element

Commuter rail could be implemented with relatively minimal construction impacts because the required right-of-way and rails are largely in place. Some localized construction impacts would occur in connection with stations and park-and-ride lots along the alignment.

3.2.3 Operations Impacts

Conservative estimates of increased 2020 ridership indicate that regional transit system improvements would reduce aggregate regional VMT in 2020 by roughly two to four percent with a roughly corresponding reduction of motor vehicle emissions (MVE) of one to four percent. The Rail/TSM Alternative would contribute to the greatest reduction of VMT and MVE, corresponding to its greater ridership. Full implementation of the PSRC Vision 2020 plan and Commute Trip Reduction Law requirements would increase transit ridership by 5 to 18 percent over the conservatively projected levels, depending on alternative. Potential technological and legislative developments could also result in increased use of lower or zero emission vehicles. The extent, nature, and interrelationships of these

developments could result in future outcomes substantially at odds with the assumed scenario in this analysis.

Although the TSM, Transitway/TSM, and Rail/TSM Alternatives all encompass substantial increases in transit service miles within the region, transit fleet emissions of carbon monoxide, nitrogen oxides, and particulate matter are expected to be substantially reduced relative to 1990 levels, as a result of new urban bus emission standards.. Transit fleet emissions may also be reduced due to greater use of HOV lanes and other transportation infrastructure improvements that expedite the transit vehicle movement. However, these benefits may be countered to some extent by transit service modifications which could lessen the some transit vehicle operating efficiencies.

The greatest potential air quality benefits of the RTP are likely to be achieved in some local areas where there will be particularly heavy transit volumes. Air quality benefits in these areas would include reduced transit vehicle emissions. There could also be some benefits associated with the improved emissions characteristics of motor vehicles operating within less congested traffic, attributable at least in part to better through and local transit service. The University District, for example, could experience a net reduction of motor vehicle emissions because of a substantial increase in electrified through transit service, substantially improved transit connections to other areas, and substantially reduced bus exhaust emissions.

Existing Transit Fleet Emissions

The current regional transit fleet consists mainly of diesel-powered buses and smaller numbers of electric buses/streetcars and gasoline-fueled vans. Table 3.2.1 indicates estimated 1990 transit fleet emissions based on the assumed average 1990 diesel bus emission factors indicated in Table 3.2.2. Data compiled in the last two months regarding the average diesel emissions of Metro's current (1992) diesel fleet indicates that the emission factors used to estimate 1990 fleet emissions of carbon monoxide and particulates were slightly higher than actual 1990 emissions of Metro's fleet However, for the sake of consistency, the EPA emission factors cited in Table 3.2.2 have been used throughout the EIS analysis for estimating 1990 transit fleet emissions and emissions per transit-passenger mile.

Table 3.2.1. Estimated 1990 Transit Fleet Emissions by Operator (Kilograms/Day)

Pollutants:	Community Transit	Everett Transit	Pierce Transit	Metro Transit	Totals
CO	563	105	618	3,283	4,569
HC	67	12	73	388	540
NOx	596	111	654	3,471	4,832
PM	103	19	113	598	10,774

Source: BRW, Inc.; Based on platform miles indicated in Table 2.1; and emissions factors from US EPA AP-42 Appendix N, Diesel Powered Transit Bus Emission Factors (DDA 6V-92TA)...

Because of tightening bus emission standards, engine manufacturers have been developing, testing, and producing new transit engine/fuel technologies which provide much better emissions characteristics than conventional diesel buses. Principal technologies include cleaner-burning diesel engines with exhaust after-treatments and engines which burn methanol or natural gas.

Table 3.2.2 contrasts the comparative emission factors of conventional 1990 diesel buses with hypothetical buses which just meet applicable 1998 emissions requirements (new diesel technologies can meet this standard) and a new state-of-the art natural gas bus.

Table 3.2.2. Comparative Motor Bus Emission Factors (grams/mile).

Source:	Est. 1990 Diesel Bus Fleet Emissions*	Bus (exactly meeting applicable 1998 standards)**	New Natural Gas Bus Engine***
Pollutants:			
Carbon Monoxide	26.2	31.6	1.5
Hydrocarbons	3.1	2.7	2.2
Nitrogen Oxides	27.7	8.1	7.3
Partic.. Matter	4.8	.1	.1

*Estimated 1990 fleet emissions based on data provided in U.S. Environmental Protection Agency. AP-42 document, Compilation of Air Pollutant Emission Factors, Appendix N - Diesel Powered Transit Buses (DDA 6V-92TA)..
**EPA 1998 Urban Bus Emission Standard converted to approximate average grams/mile.
*** Cummins L-10 Natural Gas Bus. Booz, Allen and Hamilton, 11/5/92.

Evolving engine and emission control technologies, along with changing fuel formulations, make it difficult to predict probable future bus emissions other than by assuming best available current technologies which at least meet the applicable 1998 urban bus emission standards. In the Puget Sound region, Pierce Transit and Metro have committed to using natural gas in newly acquired motor buses. Community Transit and Everett Transit have not yet decided how they will meet the new standards.

3.2.3.1 No-Build Alternative and Forecast Overview

Forecast Methodology

The MOBILE 4.1 vehicle emission model provided mobile source emission rates for carbon monoxide, hydrocarbons, and nitrogen oxides. Input data for the model was provided by the Washington State Department of Transportation, the State Department of Ecology, the Puget Sound Air Pollution Control Agency, and the Puget Sound Regional Council. Pollutant emissions were estimated based on projected transit operating characteristics and ridership, as well as projections of vehicle miles traveled (VMT) and vehicle hours of travel (VHT) and delay for each of the transit system alternatives.

Particulate emissions were not modeled, due to the lack of a readily available and reliable methodology. In addition, motor vehicle particulate emissions are of limited concern, given the limited particulate emissions of motor vehicle exhausts and the dramatic reduction of transit vehicle particulate emissions which will occur as a result of new federal urban bus emission standards. Also, the elevated levels of particulates that have been experienced within the region have generally been limited to industrial areas.

Additional air quality modeling, using the new MOBILE5 emissions model, will be undertaken in connection with the conformity review required prior to the System Plan being adopted as part of the regional transportation plan. Localized air quality analysis using the MOBILE5 emissions model will be undertaken for selected locations during project-level planning and environmental analysis associated with selection of specific alignments and facility locations.

Projected Transit Fleet Emissions

Transit fleet emissions have been projected for the alternatives by assuming that all motorized buses in the fleet will use natural gas or some other fuel/engine technology with emissions characteristics comparable to or better than the natural gas engine emission characteristics in Table 3.2.2. Table 3.2.3 indicates projected transit fleet emissions by operator for each of the alternatives.

Although commuter rail (which is expected to operate with diesel technology within the foreseeable future) is a part of the Rail/TSM Alternative, emissions from commuter rail have been tabulated separately to facilitate comparison of transit bus emissions of the alternatives. Also, emissions impacts of commuter rail operations are more localized than other transit vehicle emissions, which would occur throughout the region.

Estimated transit fleet emissions under the No-Build Alternative reflect substantial reductions of all exhaust pollutants relative to the 1990 baseline. Although the No-Build Alternative incorporates about a ten percent increase in transit service miles (see Table 2.1), No-Build fleet emissions reflect a 94 percent reduction of carbon monoxide emissions relative to the 1990 fleet, a 29 percent reduction of hydrocarbon emissions, a 74 percent reduction of nitrogen oxide emissions, and a 98 percent reduction of particulate emissions. These reductions are entirely attributable to conversion of the bus fleet to natural gas from conventional diesel technologies.

Estimated transit fleet emissions for the TSM, Transitway/TSM, and Rail/TSM Alternatives reflect increases relative to the 2020 No-Build Alternative that are generally commensurate with the increases in bus revenue miles under each of the alternatives. Specifically, bus revenue miles and transit emissions of the TSM Alternative reflect about a 75 percent increase over the No-Build Alternative. The Transitway/TSM Alternative reflects about a 80 percent increase in revenue miles and transit fleet emissions, and the Rail/TSM Alternative reflects about a 33 percent increase in bus service miles and transit fleet emissions relative to the No-Build Alternative. The lower increases for the Rail/TSM Alternative are due to the replacement of substantial numbers of buses with electric rail vehicles and commuter rail trains.

With the exception of hydrocarbon emissions, fleet emissions for all of the alternatives are less than 1990 levels. Slight increases in hydrocarbon emissions are attributable to the fact that hydrocarbon emissions of natural gas engines yield the least improvement relative to conventional diesel bus emissions. Hence, the substantial increases in bus service miles contribute to modest increases in transit fleet hydrocarbon emissions.

The relatively high carbon monoxide, nitrogen oxide and particulate emissions of the commuter rail component of the Rail/TSM Alternative more than double the volume of those pollutants produced by other transit vehicles which are part of the Rail/TSM Alternative, but the aggregate transit fleet emissions of the Rail/TSM Alternative are still very limited and less than one percent of projected aggregate motor vehicle emissions.

Table 3.2.3. Estimated 2020 Emissions by Operator and Alternative (in kg/day).*

Alternative	Community Transit	Everett Transit	Pierce Transit	Metro	Total
No-Build					
CO	47	8	39	196	290
HC	68	12	58	287	425
NOx	227	40	188	953	1,408
PM	3	1	3	13	20
TSM					
CO	90	18	44	351	503
HC	132	26	64	515	737
NOx	439	87	213	1,708	2,447
PM	6	1	3	23	33
Transitway/TSM					
CO	90	18	44	366	518
HC	132	26	64	537	759
NOx	439	87	213	1,783	2,522
PM	6	1	3	24	34
Rail/TSM**					
CO	59	11	35	277	382
HC	87	16	51	406	560
NOx	289	54	169	1,348	1,860
PM	1	1	2	18	25

* Assumes conversion of entire regional fleet to natural gas before 2020.
**Table only reflects tailpipe emissions from buses and rapid rail vehicles (no tailpipe emissions from electric rapid rail vehicles). Commuter rail operations employing diesel powered trains would generate additional estimated emissions (in kg/day) as follows: CO-340; HC-120; Nitrogen Oxides - 2670; particulate matter - 60; and Sulfur Dioxide - 200.
Source: Platform miles from Seattle Metro, 8/17/92; natural gas emission factors : Booz, Allen & Hamilton, 11/5/92.

Regional Motor Vehicle Emissions

As noted earlier, regional traffic congestion is expected to worsen in the next thirty years due to increases in regional VMT in conjunction with little increase in major roadway capacity. Estimated vehicle trip demand in 2020 is expected to significantly exceed the capacities of many principal roadways. Congestion and associated problems are likely to be particularly great where bridges are the only practical linkages between areas.

As noted earlier and illustrated in Figure 3.5, aggregate vehicle fleet emissions are trending downward, due to significant continuing but diminishing benefits from older more polluting vehicles being replaced by newer vehicles meeting current emissions standards. However, this trend is

expected to level off after about 2005. After that time, growth in regional VMT is expected to elevate aggregate motor vehicle emissions.

Table 3.2.4. Regional Motor Vehicle Emissions by Alternative (Metric Tons*/Day)* 1990-2020.

System Alternatives:	1990 Baseline	No-Build (2020)	TSM (2020)	Transitway (2020)	Rail ** (2020)
Vehicle Emissions:					
Carbon monoxide:					
All M. Vehicles	1,182.3	962.2	945.8	944.5	922.4
Transit Fleet	4.5	.3	.5	.5	.4
Hydrocarbons:					
All M. Vehicles	175.4	211.5	209.9	207.6	202.8
Transit Fleet	.5	.4	.7	.8	.6
Nitrogen Oxides:					
All M. Vehicles	128.6	139.1	136.8	136.6	133.5
Transit Fleet	4.8	1.4	2.4	2.5	1.9
Particulate Matter:					
All M. Vehicles	not avail.	not avail.	not avail.	not avail.	not avail.
Transit Fleet	.80	.02	.03	.03	.03

*Metric ton = 1,000 kg = 2,205 lbs.

**Commuter Rail emissions (also expressed in metric tons/day), which would be in addition to the emissions shown for the Rail/TSM alternative would be: CO - .34; HC - .12; NOx - 2.67; TSP - .06; SO2 - .20;

Source: BRW, Inc. based on MOBILE4.1 Emission Model; forecast of vehicle miles of travel vehicle hours of travel (as indicated in Table 3.9.3; and natural gas emission factors by Booz Allen & Hamilton, 11/5/92, and data provided by Metro and other transit operators; 2/26/92.

Table 3.2.4 summarizes estimated aggregate regional motor vehicle and transit fleet emissions for 1990 and 2020 for each of the alternatives. The separate tabulation of transit vehicle emissions highlights the minor role of transit fleet emissions with respect to aggregate motor vehicle emissions. Table 3.2.5 presents an overview of projected changes in aggregate regional motor vehicle emissions. The first row of Table 3.2.5 identifies expected percentage changes in aggregate motor vehicle emissions between 1990 and the 2020 No-Build Alternative. Given the very limited role of transit fleet emissions with respect to aggregate motor vehicle emissions, the projected changes in motor vehicle emissions are essentially attributable to the combined effects of increased aggregate regional vehicle miles of travel expected by 2020 and changed emission characteristics of the regional fleet of motor vehicles. Aggregate motor vehicle carbon monoxide emissions are projected to be roughly 18 percent lower than in 1990. However, the projected lower level for 2020 occurs within the context of a trend of increasing motor vehicle carbon monoxide emissions, as illustrated in Figure 3.5 Aggregate motor vehicle emissions of hydrocarbons and nitrogen oxides are expected to have increased by 2020.

These projections of aggregate motor vehicle emissions present rough order-of-magnitude estimates of general timing and upward or downward trends. These projections are very sensitive to specific models and input data. Use

of different models and/or different or more detailed input data could significantly alter the estimated time when aggregate motor vehicle emissions would begin increasing and/or the expected percentage increases or decreases of motor vehicle emissions in 2020 relative to 1990. However, variations in these projections are not significant with respect to evaluating comparative air quality impacts of the alternatives. The State Department of Ecology will continue to evaluate projected future motor vehicle emissions within the region in relation to its role in preparing and implementing the SIP.

The lower part of Table 3.2.5. indicates the estimated percentage changes in emissions, relative to the 2020 No-Build Alternative, for the TSM, Transitway/TSM, and Rail/TSM Alternatives. These changes are driven principally by the impact of expected ridership differences between the alternatives on aggregate vehicle miles of travel within the region.

Table 3.2.5. Estimated Percentage Changes in Regional Motor Vehicle Emissions by Alternative.

	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides	Particulate Matter
No-Build (2020): rel. to 1990	-18%	+21%	+8%	Not estimated
TSM: rel. to No-Build	-1-2%	-1-2%	-1-2%	Not estimated
Transitway: rel to No-Build	-1-2%	-1-2%	-1-2%	Not estimated
Rail: rel. to No-Build	-4%	-4%	-4%	Not estimated

Source: BRW Inc., February 1992, based on MOBILE4.1.
Particulate emissions were not calculated due to the fact that they are not expected to change significantly and the lack of a readily available and reliable forecast methodology.

Any increase in emissions of ozone precursors or particulate matter over 1990 levels is undesirable, given the current nonattainment status of the region for those pollutants. Maintenance of CO attainment status within the region may also not be easily achieved. Compliance with CO standards is based on localized concentrations of CO. Highly congested roadways or intersections producing high CO concentrations could contribute to a continuation of the region's CO nonattainment status, despite reductions in aggregate regional CO emissions. Mitigation of local CO "hot spots" might be possible through travel demand management (TDM) actions. However, in the absence of an attractive and competitive public transit alternative to encourage and facilitate greater transportation mode shifts, these TDM actions could essentially move traffic and associated emissions to other locations within the region.

While the choice of a particular regional transit system alternative will contribute to shifts toward greater transit use, other supportive actions will also be needed, such as land use patterns that are more transit- and

pedestrian-friendly and parking regulations and pricing to discourage SOV use. Achievement of air quality standards within the region will require significant measures directed toward reducing the motor vehicle emissions.

3.2.3.2 TSM Alternative

Increased service coverage and frequency under the TSM Alternative is conservatively estimated to contribute to a modest increase in transit mode share, which would result in a reduction of motor vehicle emissions of about one to two percent relative to levels under the No-Build Alternative (see Tables 3.2.4 and 3.2.5). As reflected in Table 3.2.4, slight increases in transit fleet emissions would be more than offset by reductions of motor vehicle emissions due to reduced vehicle miles of travel. It is estimated that the TSM Alternative would result in average daily reductions of at least 16 metric tons of carbon monoxide, 2 metric tons of hydrocarbons, and 2 metric tons of nitrogen oxides compared to the 2020 No-Build Alternative.

New transit bases would contribute to increased local carbon monoxide emissions near the bases, but the levels generated would be limited due to the substantially reduced emissions of future transit buses.

Under the TSM Alternative, the percentage of transit trips accessed by people driving (or being driven) to park-and-ride lots, formal drop off locations, or non-designated parking locations is projected to be about 23 percent of all transit trips as compared to the 15 percent who currently access transit by car.

Increased use of the transit drive-access options near areas which are difficult to provide good local transit coverage within is not expected to significantly affect aggregate motor vehicle emissions on either a regional or localized basis. The Transit System Access subheading in the discussion of the Rail/TSM Alternative provides an in depth discussion of the air quality implications of increased drive access to transit trips.

3.2.3.3 Transitway/TSM Alternative

Because the Transitway/TSM Alternative would only provide about three percent more service miles than the TSM Alternative, reductions of regional motor vehicle emissions would not differ significantly from the reductions under the TSM Alternative. Increased transit fleet emissions would be more than offset by reductions of motor vehicle emissions. The Transitway/TSM Alternative would result in average daily reductions of at least 18 metric tons of carbon monoxide emissions, 4 metric tons of hydrocarbon emissions, and 3 metric tons of nitrogen oxide emissions, compared to the No-Build Alternative.

Use of the I-5 reversible lanes in the North Corridor for the transitway would significantly reduce the general purpose vehicle carrying capacity of the corridor. The expected increase in transit ridership of the Transitway/TSM Alternative would not compensate for the lost general-purpose vehicle capacity of the corridor. As a result, traffic congestion and average vehicle speeds and emissions would be worse in portions of the North Corridor than would be expected under the No-Build Alternative.

Increased use of transit drive-access options would not significantly affect aggregate regional or local motor vehicle emissions. The Transit System

Access subheading in Section 3.2.3.4 provides an in-depth discussion of the air quality implications of increased drive access to transit trips.

3.2.3.4 Rail/TSM Alternative

The Rail/TSM Alternative would build on the benefits provided by the TSM Alternative with a 124-mile regional rail network. The Rail/TSM Alternative would achieve the greatest increase in transit ridership of all the alternatives. Hence it would also contribute to the greatest transit mode shift and reduce regional VMT motor vehicle emissions by roughly four percent.

Excluding commuter rail emissions, the substantial use of electric rail vehicles would substantially reduce transit vehicle emissions relative to the TSM and Transitway/TSM Alternatives. However, with diesel commuter rail emissions, the aggregate Rail/TSM transit fleet produces significantly more nitrogen oxide and particulate emissions than the TSM or Transitway/TSM Alternatives. However, similar to the TSM and Transitway/TSM Alternatives the increases in transit fleet emissions (including commuter rail emissions) would be more than offset by reductions of motor vehicle emissions. The Rail/TSM Alternative (including commuter rail) would result in average daily reductions of at least 40 metric tons of carbon monoxide, 9 tons of hydrocarbons, and 3 tons of nitrogen oxides, compared to the 2020 No-Build Alternative.

The air quality impacts of the Rail/TSM Alternative have been evaluated based on the baseline rail alignment, which within the Seattle portion of the North Corridor is the Capitol Hill/University District tunnel alignment. Development of the rail system on the North Corridor I-5 alignment would substantially alter localized traffic and air quality impacts. Use of the I-5 reversible lanes for a rail line would significantly reduce the available general purpose vehicle carrying capacity. As a result, traffic congestion and average vehicle speeds and emissions within the I-5 corridor would be only slightly better than under the No-Build Alternative.

Localized air quality impacts can be expected to occur around park-and-ride lots and stations due to increased traffic. Potential impacts of this type will be examined in detail during project level planning and analysis.

Transit System Access (Transit Stations and Park-and-Ride Lots)

Under the Rail/TSM Alternative, 26 percent of all transit trips would be accessed by driving (or being driven) to park-and-ride lots, formal drop-off locations at transit stations, or non-designated parking locations. This compares with 23 percent for the TSM, Transitway/TSM, and No-Build Alternatives and the 15 percent drive access of the current transit system.

Some DEIS commenters were concerned that drive access to the transit system would substantially diminish potential air quality benefits of improved transit operations, since high "cold-start" vehicle emission rates might occur in connection with transit drive-access trips and use of park-and-ride lots.

Vehicles operating immediately after a cold start emit roughly 30 times the emissions of engines at normal operating temperatures. On average, it takes vehicle engines roughly 8.5 minutes to reach normal operating temperatures and exhaust emission characteristics (U.S. EPA, 1977). A rough estimate was made of the comparative emissions of making trips to and from a park-

and-ride lot at a distance of 1.5 miles (assuming 100 percent cold-start emissions each way for the park-and-ride lot trip) versus making a 20 mile home-to-work-and-back round trip. The emissions produced by the park-and-ride lot trips (consisting entirely of cold start emissions) amounted to fifty percent of the emissions produced by the round commute trip. This suggests that transit drive access trips probably produce significantly fewer emissions than the drive commute trips they replace. However, transit drive access trips clearly produce more emissions than would be produced by equivalent nonmotorized access transit trips.

Commute trip options and their associated vehicle emissions consequences tend not to be as simple as the above analysis suggests. Many of the transit trips accessed by driving would not occur without the drive access option. Even with good local transit service in the draw areas of drive-access facilities, many potential transit users, because of where they live relative to local transit service options, find local transit access either too inconvenient and/or slow relative to the convenience and speed of commuting by car or accessing transit by car. In addition, without good transit drive access, overall transit ridership is likely to be lower and the number of low-occupancy-vehicle commute trips (most of which involve cold-start emissions which are likely to persist for longer periods of time than would occur with a park-and-ride access trip) is likely to increase. Finally, experience with existing facilities such as park-and-ride lots shows that when these facilities, the volume of transit passenger drop-offs and use of undesignated parking areas tends to increase significantly.

It is also not clear that potential motor vehicle emission consequences associated with reduced drive access facilities would be less than those of transit system alternatives incorporating greater selective use of drive access facilities. While individuals who take the bus all the way from their homes to work and back do not contribute to cold-start or other vehicle emissions, they or someone else in their household will be more likely to contribute to local vehicle emissions in the course of making local convenience or errand trips that might otherwise have been linked to a transit-access trip. This is due to the fact that errands that might have been linked to transit-access trips must still be made and are likely to involve use of an automobile. Also, vehicles left at home by individuals who directly access transit trips make it easier for other household members to make other vehicle trips.

In summary, reductions in vehicle emissions from reduced use of drive access options would in many instances be overshadowed by increased emissions from increased numbers of low-occupancy-vehicle commute trips (which are likely to contribute to both local cold-start emissions and greater aggregate emissions) and increased numbers of unlinked local trips.

From a local perspective, it is even more difficult to assess whether there are likely to be net air quality gains or losses from reducing transit drive access options. In general, the impact would depend on the local importance and attractiveness of particular transit drive-access options compared to the difficulties of providing good local transit service.

If increased numbers of very low to zero emission vehicles are driven within the region in the future, the issue of motor vehicle emissions in relation to increased use of transit drive access options would subside. Also, if the use of electric vehicles becomes more common, their expected shorter driving range is likely to make them an attractive option for transit drive access trips.

Indirect Emissions of Electric Transit Vehicles

Less than one fifth of the power used by an electric rail system within the Puget Sound region would be supplied from fossil fuel generating plants. About 80 percent of the region's electrical power is provided by hydroelectric generating plants. The percentage of the regional electrical power supply provided from fossil fuel burning plants is expected to remain low; any additional fossil fuel electrical power plants would have to comply with increasingly stringent emission limitations.

The Bonneville Power Administration currently anticipates that natural gas is most likely to be used to fuel additional generators. Such a facility might be constructed within the central Puget Sound regional airshed. However, it would have to meet stringent new source emission requirements, which include emissions offsets for pollutants for which the area is designated nonattainment and for which the source is considered a "major source."

Commuter Rail

Commuter rail would probably initially use diesel-electric locomotives. Table 3.2.6 indicates estimated average grams per mile and metric tons per day of carbon monoxide, hydrocarbons, nitrogen oxides, particulate matter and sulfur dioxide that would be generated by commuter rail operations. In the absence of stricter emissions controls or improved commuter rail engines, commuter rail will contribute significantly greater volumes of carbon monoxide, nitrogen oxides, and particulate matter per average expected passenger mile than natural gas buses. The relatively high emissions of commuter rail is partially due to the fact that unregulated rail diesel emissions are being compared to state-of-the-art natural gas bus emissions. While new regulations and/or new rail engine developments resulting in the use of cleaner rail engines could occur over the time horizon of the RTP, neither the timing or specific character of such developments can be predicted or assured. The per-passenger-mile emission rates of commuter rail versus buses, SOVs, and three-person carpools are illustrated in Figures 3.3 and 3.4. The average emissions per passenger mile of commuter rail are greatly diluted by its much higher average passenger load.

Table 3.2.6. Estimated Commuter Rail (Diesel) Exhaust Emissions

Pollutant	Emissions (Metric Tons/Day)	Emissions (Average Grams/Mile)
Carbon Monoxide	.34	70.4
Hydrocarbons	.12	23.7
Nitrogen Oxides	2.67	554.8
Particulate Matter	.06	13.1
Sulfur Dioxide	.20	40.4

Source: BRW Inc., March, 1992. Fuel consumption data from Operating and Maintenance Cost Methodology Report, Commuter Rail Transit, January 15, 1992; emissions data provided by Jim Stoetzel, Burlington Northern Railroad Commuter Rail Line Manager.

3.2.4 Mitigation of Impacts

Construction impacts could be reduced by incorporating mitigation measures into construction specifications. Mitigation to control fugitive dust, deposition of particulate matter, and emissions of CO could include:

- o Surfacing of roadways, road shoulders, parking lots and storage areas. Surfacing these areas with gravel or spraying with water or biodegradable soil stabilizers would reduce particulate emissions.
- o Stabilizing storage piles and material handling and transfer areas by covering with tarps, enclosing materials in buildings, or spraying with water. Water from spraying operations could be returned to the soil profile and some might percolate down into the water table. Particulate matter, along with any transported contaminants, would be removed physically as the water filters through the soil profile.
- o Spraying grade and fill operations with water could reduce particulate emissions by up to 50 percent.
- o Wetting materials in trucks, using coverings, or providing adequate freeboard (space from the top of the material to the top of the truck) would reduce fugitive dust and deposition of particulates.
- o Locating construction area access points away from sensitive receptors may be used to reduce exposure to particulates.
- o Providing wheel washers to reduce particulate matter carried offsite would decrease deposition of particulate matter on area roadways.
- o Removing particulate matter deposited on paved roads would reduce mud on area roadways.
- o Routing construction trucks to avoid populated areas and to reduce traffic delays during peak travel times would reduce the population exposed and the pollutants emitted.
- o Requiring appropriate emission control devices on construction equipment would reduce CO emissions. Using relatively new, well-maintained equipment also would reduce CO emissions.

Selection and/or development of mitigation measures will be determined and documented in project-level environmental review. Mitigation to reduce long-term emissions should not be needed under the build alternatives, assuming improvement over the No-Build and that no nonattainment situations result from improvements. These determinations will be made during project level environmental review.

3.2.5 Conformity Statement

The project area includes non-attainment areas for carbon monoxide, ozone, and particulate matter. Revised SIPs have been published by the Washington State Department of Ecology and are expected to be approved by the U.S. EPA. These include a newly adopted state conformity regulation (Chapter 173-420 WAC) which establishes an approval process based upon all applicable state and federal environmental and transportation regulations, including the Clean Air Act Amendments, the Intermodal Surface Transportation Efficiency Act, the State Growth Management Act, and the Washington State and federal Environmental Policy Acts. The key conformity requirements are that transportation activities not:

- o cause or contribute to any new violation of the National Ambient Air Quality Standards (NAAQS)
- o increase the frequency or severity of any existing violation of the NAAQS, or
- o delay the timely attainment of the NAAQS.

Determinations of conformity are made on the regional level by the PSRC in cooperation with the Department of Ecology and other jurisdictions. The PSRC has previously found the Vision 2020 Plan to be in conformity with the SIP. The PSRC has also indicated that the Rail/TSM Alternative is the most supportive (of the alternatives considered) of the adopted Vision 2020 Plan. A formal finding of conformity with the Vision 2020 Plan is anticipated by the PSRC Transportation Policy Board and Executive Board on the Final System Plan after its adoption by the JRPC. A finding of conformity with the SIP is likely to follow if the Rail/TSM Alternative is the basis for the Final System Plan.

3.3 Noise and Vibration

3.3.1 Affected Environment

3.3.1.1 Terminology

Noise

Noise is annoying, disturbing, unwanted sound. The impact of noise depends on the levels and characteristics of background noise sources. The same noise may be disruptive within a quiet environment and unnoticed within a noisy environment.

A logarithmic decibel (dB) scale is used to measure noise levels. Because human perception of sounds depends on their frequency or pitch, a special "A-weighted" frequency scale (dBA) is used to measure environmental noise levels. All noise levels cited in this discussion are measured on the dBA scale.

Transit-generated noise varies considerably over time. There are several noise descriptors that can be used to express and evaluate transit noise impacts. Lmax represents the maximum level of a noise source. Leq measures the average sound level occurring over a designated period of time (such as an hour). Lmax and the peak hour Leq are preferred descriptors for rail noise. Leq is also an appropriate measure for bus noise.

The day-night sound level (Ldn) is similar to a 24-hour Leq, but adds a 10 decibel penalty for all noise occurring between 10:00 p.m. and 7:00 a.m. The Ldn is particularly appropriate where transit operations are located near residential areas and activities sensitive to early morning or late night noise.

Vibration

Ground vibration refers to time-dependent movement of the earth. Amplitude and frequency are the key variables associated with ground vibration. Amplitude is the peak displacement of ground at a given location during a specified time interval, defined in terms of displacement (distance of

movement), velocity (speed of movement), or acceleration (rate of change of velocity). Frequency is the rate at which the ground vibrates through a full cycle and returns to its original position.

3.3.1.2 Criteria

Noise

There are no federal standards pertaining to noise exposure from rapid transit projects. However, a variety of noise criteria have been developed to help assess the significance of transportation-related noise impacts and identify the levels at which noise abatement or mitigation measures are appropriate.

Federal Highway Administration (FHWA) guidelines provide that noise impacts from highways occur when noise substantially exceeds existing levels or exceeds criteria for various land use categories (Figure 3.7). For category "A" land uses, the hourly Leq should not exceed 57 dBA. For category "B" land uses, the criterion is 67 dBA. The category "C" criterion is 72 dBA.

The Federal Transit Administration's (FTA's) noise criteria for rail transit provide that a peak hour increase of three dBA (Leq) or less is an insignificant impact. A peak hour increase of 4 to 10 dBA (Leq) is possibly significant and may require mitigation, depending on existing noise levels and the presence of sensitive receptors. An increase of 10 dBA (Leq) or more is probably significant and will probably require mitigating measures.

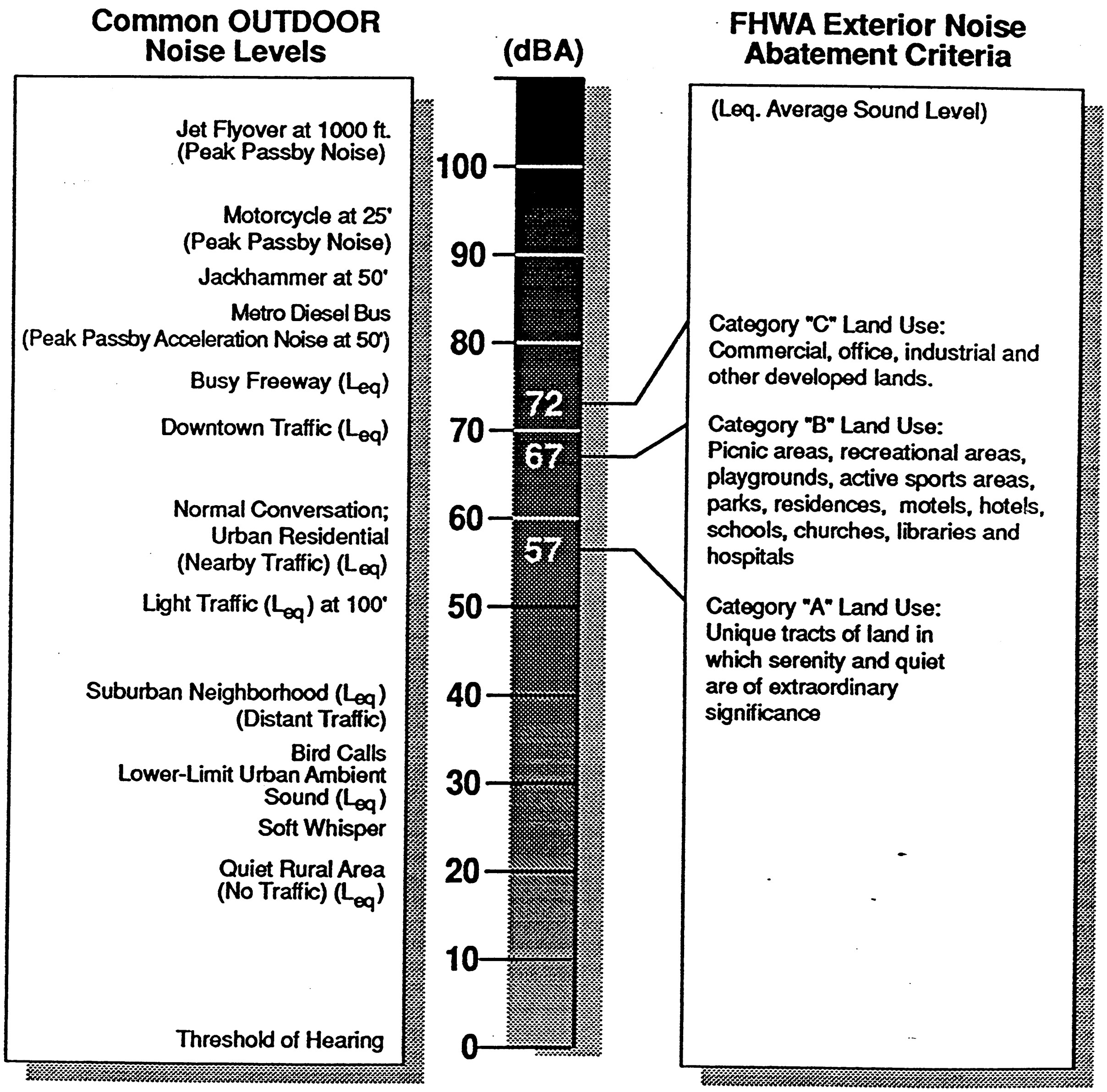
Environmental Protection Agency (EPA) guidelines categorize noise impacts based on the amount of change in noise levels. Most people do not notice an increase in noise of 3 dBA or less. An increase of up to 5 dBA is considered a slight impact. An increase of 5 to 10 dBA is considered a significant impact, and an increase of more than 10 dBA is considered a serious impact.

The EPA does not regulate environmental noise levels. However, it has studied the effect of noise levels on public health and welfare and identified guidelines for sound levels. An Ldn of 55 is specified for outdoor areas in which quiet is a basis for use. A 24-hour Leq of 55 is specified for outdoor areas where people spend limited amounts of time.

The Department of Housing and Urban Development's (HUD) guidelines recommend an outdoor day-night sound level (Ldn) of 65 dBA or less as an "acceptable" noise exposure level. Common building construction methods result in acceptable indoor noise levels and outdoor levels are relatively pleasant for recreation and play. The HUD guidelines stipulate that an Ldn above 65 is normally unacceptable. If noise is at or above this level, barriers may be required to reduce exterior sound levels to acceptable levels. Special construction measures may be necessary to ensure that outdoor noise levels are properly attenuated. The HUD guidelines provide that an Ldn in excess of 75 dBA is unacceptable.

The American Public Transit Association (APTA) has guidelines for maximum rapid transit noise levels (Lmax) within various land uses (Table 3.3.1). APTA has also specified maximum exterior noise levels for particular uses, including 75 dBA for churches, theaters, schools, hospitals, museums, and libraries; 70 dBA for concert halls, radio and television studios, and

NOISE LEVELS



Regional Transit Project
KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY
RTPF0204P

Outdoor Noise Levels and Noise Abatement Criteria
System Plan EIS
FIGURE 3.7

auditoriums; and 65 dBA for "quiet" outdoor recreation areas. Noise above the guidelines could be a significant impact. APTA has also prescribed design criteria for maximum transit groundborne noise for different land uses, building types, and room uses.

Local governments generally do not regulate overall transportation noise on public rights-of-way. An exception is Bellevue, which requires a noise analysis if existing or projected peak-hour traffic noise exceeds Leq 67 dBA on adjacent properties or if noise levels will increase by 5 or more dBA. Most local noise control ordinances limit the maximum noise at 50 feet for heavy motor vehicles, including trucks and buses, to 83 dBA.

In Seattle, construction noise can generally exceed normal daytime noise limits by up to 25 dBA, with short-term allowances for higher levels up to 99 dBA. Night noise within residential areas is generally limited to 45 dBA or existing noise levels.

Table 3.3.1. APTA Maximum Single Event Noise Level Design Goals.

APTA Community Area Category	Lmax Design Criteria, dBA: Single-Family	Multi-Family	Commercial Buildings
I - Low Density Residential	70	75	80
II - Average Density Residential	75	75	80
III - High Density Residential	75	80	85
IV - Commercial	80	80	85
V - Industrial	80	80	85

Source: APTA 1981.

Vibration

Based on laboratory research and field observations, various guidelines have been formulated to specify vibration thresholds for potential human annoyance or structural impacts. The U.S. Department of Transportation (USDOT 1979) has suggested vibration thresholds to be used to evaluate proposed transportation improvements.

3.3.1.3 Sources of Noise and Vibration

Noise

Transportation systems generally produce the most noise within urban areas. Principal sources include airplanes, railroads, and motor vehicles. Aircraft produce some of the loudest ambient noise levels within the region. Noise from traffic and rail operations is focused along principal railroad and roadway corridors.

Traffic noise levels are highly variable depending on a variety of roadway characteristics and traffic variables that differ by roadway and time. Traffic speed is one of the most critical variables. At slower speeds, motors and exhaust systems are the principal sources of noise. At the higher speeds characteristic of free-moving highway traffic, road/tire contact noise is a significant component of traffic noise.

Higher volumes of traffic generally produce higher noise levels. However, the effect of increasing traffic volumes tends to be more significant on roadways with lower traffic volumes. In general, a doubling of traffic volumes along a roadway increases average traffic noise levels by about 3 dBA. A change in noise level of 3 dBA is barely perceptible. When increased traffic volumes reach or exceed roadway capacities, the resultant slower vehicle speeds frequently reduce traffic noise levels for periods of time. The levels of traffic noise reaching adjacent land uses are also significantly influenced by distance between traffic lanes and abutting land uses.

Noise from rail operations is more variable (broken into discrete pass-by episodes) than roadway noise. Railroad noise depends on the types of trains, the numbers and lengths of trains, and their operating speeds. Rail noise is also affected by the design and maintenance of the vehicles and track. In addition, at-grade rail operations across roadways involve use of vehicle whistles and roadway crossing bell signals.

The significance of general traffic, bus, and rail noise depends not only on the pattern, level, and character of the noises from each source, but also on the particular types of land uses and activities that occur along affected corridors and their sensitivity to noise.

Vibration

Natural sources of ground vibration include fault displacements, land slippage, and the response of objects to wind. Vibration is also caused by explosions, machinery, and heavy equipment such as pavement breakers. Cars, buses, trucks, and rail vehicles can contribute to ground vibration by causing pavement or rails to vibrate. The vibration can be transmitted through the ground to nearby structures. The strength of these vibrations depends on vehicle technology, weight, and speed, and roadway roughness. The strength of ground vibration diminishes very rapidly with distance. The amount of reduction depends in part on soil type and underlying geology.

3.3.1.4 Ambient Conditions

Traffic Noise

Along many freeways, highways, and arterial roadways in the project corridors, average traffic noise levels reaching nearby residential areas exceed the 67 dBA (Leq) standard set by FHWA. Average freeway noise levels range from about 63 to 78 dBA (Leq) at nearby structures. Noise adjacent to SR-99 ranges from 73 to 81 dBA. Noise along Rainier Avenue South and Martin Luther King, Jr. Way ranges from 64 to 68 dBA. The differences are due to factors including speeds, vehicle mix, and setbacks.

Bus Noise

Noise from buses depends on the bus sizes and types. Electric buses are considerably quieter than diesel buses. There are also slight variations depending on engine type and coach size and weight. Diesel engines tend to produce more noise than equivalent gasoline engines. People usually find the general character and frequency range of diesel engine noise annoying. When idling or operating at low load, diesels tend to "clatter" and to produce a more metallic sound than gasoline engines. The generally lower frequencies of diesel noise compared to gasoline engine noise tend to result in greater levels of noise penetrating nearby buildings (OECD 1986).

The peak accelerating noise (Lmax) produced by the diesel coaches currently operated by Metro ranges from about 80 to 83 dBA at a distance of 50 feet. Peak cruising noise, even at high speeds, is somewhat less than peak accelerating noise. The significance of transit noise depends on background traffic and the mix of vehicle types. On heavily traveled roadways, the contribution of bus noise to total traffic noise is generally very limited.

Rail Noise

Segments of existing railroad lines are being considered for portions of the regional high capacity transit system. The rail system under consideration may use segments of the BNRR right-of-way between Bellevue and Renton. Noise from this line is low due to limited use and low speeds.

Commuter rail is proposed along the rail corridor in the Green River Valley between Tacoma and Seattle. The Burlington Northern (BN) and Union Pacific (UP) Railroads have separate rights-of way in this corridor, with a common right-of-way between Georgetown and Tukwila. Both lines run through predominantly industrial, commercial, and agricultural areas. However, portions of both lines abut residential uses.

The BN line is welded rail double-track, with an average of 50 freight trains and six AMTRAK passenger trains per day. Freight trains operate at speeds up to 50 mph and passenger trains operate at even higher speeds. From a distance of 50 feet freight trains operating on welded rails generally have an Lmax of 84 dBA at 35 mph and 90 dBA at 55 mph. Trains operating on jointed rails generally produce noise levels about 4 dBA louder. The UP line is a jointed rail single-track and carries an average of 12 trains per day operating up to 40 mph. Noise levels are somewhat lower and rail pass-by noise episodes are less frequent along the Union Pacific line. The segment of the corridor with a common right-of-way experiences combined noise from the two railroads.

Vibration

There are almost constant background vibrations within most urban environments, most of which are imperceptible except to extremely sensitive monitoring equipment. Ground vibration is generally only of concern if it annoys people or damages structures. At some locations, such as those with very sensitive laboratory equipment, sensitivity to ground vibration may be much greater.

Low level ground vibration is generated in all transportation corridors, but is generally below the threshold of human perception. Peak vibration levels caused by very heavy vehicles may be perceptible within 5 to 10 feet of traffic lanes. Even the strongest traffic-induced vibrations generally diminish to levels that are imperceptible to humans within 20 feet of roadways (PSCOG 1983).

3.3.2 Construction Impacts

Construction noise and vibration impacts would be experienced by people who live in, work in, or visit the immediate vicinity of construction sites.

Noise

Construction noise impacts are likely to be significant in some areas due to the character, magnitude, and duration of construction. Construction equipment noise varies, depending on the types, size, and age of equipment and the types of operations. Most construction equipment produces noise levels from 72 to 94 dBA at 50 feet, with heavier equipment tending toward the high end of this range. Some operations, such as concrete breaking and pile driving, generate more noise, including peaks above 100 dBA. The levels of construction noise reaching abutting buildings or residences would be even higher than the levels where construction occurs closer than 50 feet from affected structures.

Vibration

The significance of construction vibration impacts will depend on the types of construction activities that occur at specific locations. Major concrete demolition and major excavation or tunneling is the most likely to generate significant vibration impacts. Percussive pile driving could be a significant short term source of vibration affecting nearby structures. The significance of impacts depends on construction methods, distance, types of nearby buildings and human activities, and mitigation measures. Project-level analysis will identify operations that are likely to generate significant levels of vibration, vibration-sensitive structures and activities, and specific mitigation measures.

3.3.2.1 No-Build Alternative

Under the No-Build Alternative, construction noise impacts would be limited to that of construction of currently adopted projects. Some of these construction activities could generate significant local noise impacts.

3.3.2.2 TSM Alternative

Expansion of the HOV lane network, park-and-ride lots, and access roadways would result in temporary local construction noise and vibration impacts at project sites. Noise impacts would be expected to be limited, but there could be some project sites where construction noise impacts could be significant.

3.3.2.3 Transitway/TSM Alternative

Because of the additional construction activity associated with construction of busways and related support facilities, this alternative would probably generate more construction noise impacts than the TSM Alternative but considerably less than the Rail/TSM Alternative.

North Corridor

Building new access tunnels and ramps connecting the I-5 express lanes with Convention Place Station and the University District would cause considerable noise, much of which would occur within the I-5 right-of-way and generally be blanketed by traffic noise. However, some of the work is likely to occur at night when there is generally less traffic noise and construction noise would be more noticeable in nearby residential areas. Noise from construction of the transitway on the reversible lanes of the I-5 Ship Canal bridge could seriously affect adjoining residential areas.

South Corridor

Most of the new busway would follow the BN and I-5 rights-of-way through industrial areas. Because of this, construction noise would be blanketed by background traffic and industrial noise and would not affect nearby land uses.

East Corridor

Construction of the aerial busway between Southeast 8th Street and SR-520 would generate considerable noise. Much of the noise would be somewhat blanketed by existing traffic noise, but work at night may generate noise levels that could affect nearby sensitive uses.

3.3.2.4 Rail/TSM Alternative

The Rail/TSM Alternative would result in the greatest amount of construction noise and vibration because of the magnitude, geographic extent, and type of construction required. Depending on location, proximity of adjacent uses, construction techniques, and effectiveness of mitigation, construction noise and vibration could significantly affect adjacent structures and activities.

Construction of subway stations and tunnel segments will require the heaviest and most sustained construction activity. The majority of the tunnel alignments would probably be constructed using tunnel boring techniques. Where tunnels are bored, surface construction may be considerably less than would be experienced with cut-and-cover construction, with a great deal of surface construction activity focused at tunnel portals and temporary construction access portals.

At tunnel portals, there may be considerable noise from staging, loading, and transporting construction equipment and materials, as well as from ventilation or other mechanical systems. Many portal activities are likely to continue through the night. Routes used to transport excavation spoils and other construction materials to and from portals would experience increased heavy truck noise over extended periods of time.

Even when tunnels are bored, there is likely to be considerable surface construction along the alignment, including utility work and grouting and/or dewatering operations, and a variety of other activities and operations. Surface improvements along bored alignments may range from restoring affected areas to total upgrading of rights-of-way, including removal and replacement of the entire street and many of the utilities.

Some tunnel segments, including most transitions to at-grade or elevated alignments, and most subway stations will be built using cut-and-cover construction within street rights-of-way. The cut-and-cover technique would involve substantial to very extensive utility relocation work, demolition and removal of street surfaces, placement of perimeter retaining structures, construction of temporary street and sidewalk decking, soil excavation, modification of any affected building foundations, construction of station or tunnel structures, backfilling, and reconstruction of the roadway. The cut-and-cover technique would produce substantial periods of loud construction noise, which would be likely to affect nearby businesses, residences or other land uses. In addition, routes used to transport excavation spoils and other construction materials would experience increased heavy truck noise over extended periods.

It may be possible to construct deep subway stations using subsurface mining techniques. This technique would considerably reduce surface noise from construction. However, there would still be significant surface construction at station locations to build station access and ventilation portals. Moderate to extensive street improvements may also be required, which would increase surface construction noise impacts.

Tunnel and subway construction may also increase levels of vibrations that could adversely affect nearby structures and activities, particularly near sensitive land uses such as hospitals, research facilities, or historic structures. The strength of construction-induced vibrations is heavily influenced by the specific types of construction equipment and operations, the depth of construction, and the distance to potentially affected structures. Unusual soil properties could exacerbate vibration impacts. Major construction activity directly abutting buildings would be more likely to cause vibration that could annoy people, adversely affect equipment, or cause minor structural damage. Where needed, special construction techniques or measures can minimize significant vibration impacts. Vibration monitoring equipment can also be used to help maintain impacts within specified levels.

Aerial guideway construction would generally involve considerably less heavy demolition and construction noise than cut-and cover tunnel construction. However, the aggregate impacts of building an aerial guideway would be influenced by the extent of street and utility improvements required in conjunction with the project. Depending on the extent and magnitude of required right-of-way improvements for specific bored tunnel and aerial guideway segments, the relative magnitude of construction noise could be comparable.

Some construction is likely to extend into late evening or nighttime hours. Major construction within roadway rights-of-ways, particularly urban streets, is likely to require significant nighttime construction in order to maintain adequate daytime traffic movement and local access. Utility work requiring service interruptions is generally scheduled at night to reduce inconveniences and may be noisy. Major earth work and excavation within street rights-of-ways also tend to involve occasional utility damage requiring immediate emergency repairs that may extend into nighttime hours.

When nighttime construction noise occurs near residences or other buildings such as hotels, hospitals, or long-term care facilities, it is particularly likely to be disruptive. Although local noise regulations generally prohibit significant

nighttime construction noise within residential zones, many people live in other types of land use zones and may not be protected from nighttime noise.

Construction may require noise variances that grant relief from standard noise limits for specific projects to shorten project duration. Such variances would significantly increase nighttime noise construction in affected areas. Any sensitive land uses in such areas could be seriously affected.

Careful scheduling and choice of construction techniques and equipment can significantly reduce noise impacts. However, even with use of substantial noise mitigation measures, some construction activities, such as concrete breaking, are likely to cause considerable noise impacts when they occur over significant periods of time near occupied structures.

North Corridor

Construction of the I-5 alignment in the central portions of Seattle, including potential cut-and-cover tunnel construction between Convention Place Station and Mercer Street and major construction on the Ship Canal bridge and other I-5 structures would produce considerable construction noise near residential areas. Much of the work would probably require substantial late evening or nighttime construction activity to reduce traffic impacts. Although background traffic noise would help to mask construction noise, some nearby residences could still experience considerable noise, particularly during demolition work. In some areas, noise could be accentuated by reflection off retaining walls or the upper deck of the I-5 Ship Canal bridge.

Construction of a below-grade people mover in the University District for the I-5 alignment would involve large scale construction over a substantial area for an extended period of time. Such a project would probably involve substantial surface construction and require significant nighttime work to reduce traffic impacts. Noise could significantly affect both residential and commercial activities within the district. Various mitigation techniques could be used to reduce noise impacts.

The Capitol Hill alignment between Convention Place and the University District would be constructed by boring. Surface construction would focus at tunnel portals, including temporary construction access portals, subway station locations, and ventilation/emergency access shafts. However, there could also be considerable surface construction along much of the alignment in immediate proximity to commercial, institutional, and residential land uses.

Construction of the Aurora/SR-99 alignment would probably involve tunnel or aerial guideway segments along the transition between I-5 and SR-99. This portion of the alignment would probably cut through residential areas and involve heavy construction activity near residences, with considerable noise impacts.

South Corridor

Construction of subway and aerial guideway segments along the Rainier Avenue South/Martin Luther King Jr. Way South alignment would generate significant construction noise near residences.

Commuter Rail Element. Development of the commuter rail line would probably produce relatively limited localized construction noise from construction of station and park-and-ride facilities. Rail line upgrades would involve relatively limited construction activity and noise.

East Corridor

Tunnel construction in downtown Bellevue could generate substantial noise in some areas. Although most of the tunnel would probably be bored, a portion of the southern approach would probably involve cut-and-cover construction near residential areas, motels and hotels. Subway stations would probably be constructed with cut-and-cover techniques, resulting in considerable surface noise over substantial periods of time. The northern subway station might be located close to residential areas where construction noise impacts would be greater.

3.3.3 Operations Impacts

Noise from regional transit operations will depend on the types of vehicles and equipment used, the character and locations of the alignments, and the impacts of the new facilities and transit operations on background traffic patterns. Locally increased noise may occur due to changed traffic patterns, increased bus operations, new rail transit or commuter rail operations, or bus or rail operations at transit stations, park-and-ride lots, new vehicle maintenance and storage facilities, or other new transit facilities.

The character and level of local noise impacts from either bus or rail operations will depend on their proximity to noise-sensitive land uses, local noise levels, and the location and design of facilities. With the exception of tunnel segments, most rapid transit facilities would be located within existing freeway, highway, arterial, and railroad rights-of-way, where noise levels are relatively high. However, some of the facilities would be developed in outlying areas where noise levels are lower than on principal roadway corridors.

Traffic noise within the region is expected to increase with or without regional transit improvements. Although the build alternatives will cause some shift of riders from low occupancy to high occupancy vehicles, the reduction in regional VMT is expected to be relatively modest.

Bus and train operation can contribute to roadway vibration. The significance of such vibration depends on roadway structure, vehicle weights and speeds, local soils, and the distance between roadways and potentially affected structures. Generally, roadway engineering prevents perceptible levels of vibration from reaching adjacent areas or structures.

3.3.3.1 No-Build Alternative

Future traffic noise levels are expected to be slightly elevated relative to current levels. Many roadways will experience modest increases in noise from increased traffic volumes and longer peak traffic periods. Many roadways may also experience periods of reduced traffic noise due to slower vehicle speeds as traffic volumes exceed road capacities. Local changes in traffic noise levels may also occur as drivers use alternate routes when confronted with severe congestion. Changes of this type could contribute to increased traffic noise on local and minor arterial streets.

3.3.3.2 TSM Alternative

The peak noise level or Lmax from a bus operating at 35 mph is generally about 74 dBA at a distance of 50 feet. At 50 mph the peak noise level is about 80 dBA. These levels are about 10 dBA greater than peak noise from automobiles, and are roughly comparable to noise produced by medium to large trucks.

New or expanded transit stations, park-and-ride lots and HOV lane access points may contribute to local increases in traffic volumes and noise that could affect nearby residential areas or other sensitive land uses. New HOV lanes will probably contribute to increased vehicle speeds, which could slightly increase traffic noise in some areas. New HOV lanes may also result in traffic lanes being moved closer to abutting land uses, although in most instances the change in noise levels would be slight.

Noise from bus operations will depend on the mix of buses in the fleet, along with miles and hours of service by vehicle type. Increased bus operations on HOV lanes could affect approximately 31 miles of roadways that are bordered by residential and other sensitive land uses, including portions of I-5 between the ship canal and south Snohomish County and I-405 between Snohomish County and Renton, Because of the high traffic noise along freeways and other principal roadways, increased bus operations would not be expected to significantly affect noise levels. Along freeways, the noise from vehicles traveling within HOV lanes may dominate when general purpose traffic lanes are particularly congested.

Increased vibration could reach nearby properties where the construction of new lanes reduces the distance between traffic and abutting properties. However, the increases would not be expected to be significant.

3.3.3.3 Transitway/TSM Alternative

In addition to the impacts from TSM improvements, transitway operations could slightly increase noise and vibration near new busways and transitways. Because the facilities would be mostly on freeways, the potential increases in noise and vibration are not expected to have any significant impact. Transitway operations at some limited locations, such as on the reversible lanes of the I-5 Ship Canal bridge, could result in noise impacts.

3.3.3.4 Rail/TSM Alternative

Rail Operations

People living or working close to rail alignments could experience noise or vibration impacts from train operations, station activities, tunnel ventilation shafts, and maintenance work. The significance of impacts would depend on local noise levels and the distances between rail facilities and other land uses and structures. Rail operations noise is likely to be less significant within heavily traveled rail or highway corridors than where alignments pass through quieter areas.

The maximum noise produced by rail transit tends to be 2 to 5 dBA greater than noise from buses at comparable speeds. However, both bus and rail

noise levels and characteristics are highly variable, depending on specific technologies, equipment, operating parameters, and alignment characteristics. Sources and levels of noise from rail operations depend on the type of propulsion system, track and supporting structures, wheels and axle trucks, braking system, and noise mitigation.

The most significant sources of rail noise tend to be wheel noise, noise from elevated structures, groundborne noise, and propulsion system noise (Saurenman 1982). Steel wheels on steel rails can be a major source of noise. Potential wheel/rail noise falls into three broad categories. Squeal (or screech) is a high-pitched noise produced as trains round sharp curves. Impact noise is the "clickety-clack" or banging caused when trains pass over uneven track joints. Modern railroad systems generally use welded rails, largely eliminating impact noise. However, worn areas on wheel rims can generate similar noise. "Roar" is a steady sound produced as a result of small rough areas on wheels and/or rails. State-of-the-art wheel and track technologies and maintenance have substantially reduced screech and impact noise.

The vertical profile of rail guideways can be a significant variable with respect to the levels of noise. Below grade alignments generally introduce the least amount of noise. The only at-grade noise associated with tunneled guideways comes from ventilation ducts and tunnel portals. Of the non-tunnel options, retained-cut guideways generally cause the least noise impacts because they reduce or eliminate line-of-sight noise paths. In the absence of noise barriers, at-grade rail operations radiate considerably more noise into abutting areas than retained-cut guideways.

Elevated guideways can be significant sources of noise. Vibration and noise from wheels on rails can be transmitted to supporting structures. Vibrating structures can in turn radiate significant noise to surrounding areas. Aerial structures may also increase noise impacts due to greater elevation relative to surrounding buildings, which may result in radiating noise further into surrounding areas. Aerial structures may also transmit through openings in supporting structures and may deflect traffic noise. However, the difference in elevation of adjacent land uses can also result in lower noise impacts.

Noise from elevated structures is generally less of a problem in modern transit systems built entirely of concrete or incorporating a concrete deck supported by steel girders (Shearer 1986). Sound barriers on aerial structures can reduce noise levels to below the levels characteristic of comparable unscreened at-grade facilities.

A rail line's horizontal profile can also contribute to significant local noise. Rail operations around sharp curves are more likely to produce screech from the interaction of rails and wheels. Steeper grades are likely to increase propulsion system noise during ascents and brake noise during descents. However, most modern commuter and electric rail systems use electrical regenerative braking systems, which eliminate most brake noise.

Rail operations also introduce a certain amount of vibration into the ground and adjacent structures along rail alignments, which could damage historical structures, adversely affect the functioning of sensitive equipment, or annoy people. Occupants of affected buildings can either "feel" vibration as mechanical motion or hear it as a low-frequency rumbling. Although groundborne noise and vibration are most likely to be noticed near tunnels,

they can be potential problems near any type of rail structure. Modern vibration testing and analysis techniques can be used to predict vibrations and help design rail systems to reduce vibration to acceptable levels.

The rail system trains will probably have an average cruising speed of about 50 to 55 mph, but could, depending on technology, have cruising speeds of up to 70 mph along some segments. Peak pass-by noise at a distance of 50 feet for trains traveling at 50 mph for six of the newer rail transit systems in North America ranges from 72 dBA for the Sky Train system in Vancouver, B.C. to 90 dBA for the Folson light rail line in Sacramento, California. Peak pass-by noise for the six systems inventoried generally increases by about 2 dBA for each additional 10 mph increment. In sections with noise barriers, the noise produced by Sky Train operating at 50 mph is reduced to about 63 dBA. Excluding the Sacramento system, which is notably louder than the other lines, the average 50 mph pass-by Lmax is about 81 dBA. The average pass-by noise level at 25 mph at 50 feet is about 77 dBA.

Trains would only reach maximum cruising speeds along limited segments of track. The highest cruising speeds would only be reached along the long straight alignment segments, generally located in outlying areas. The pass-by noise experienced along much of the alignment would be altered by lower speeds and noise from train acceleration and braking. Rail noise and vibration within the Downtown Seattle Transit Tunnel would be modest due to low operating speeds in the tunnel and noise and vibration attenuation measures in rail vehicles and their wheel assemblies.

An electric rail line on the BNRR right-of-way between Renton and Bellevue could have serious noise impacts where the alignment abuts residential areas. Noise impacts from existing rail operations are limited due to the very limited use of the tracks and low speeds. The new rail line would involve a number of trains operating at much higher speeds throughout the day and during early morning and late evening hours.

Rail car storage and maintenance yard facilities would be a local source of noise. These facilities would be located within industrial or other areas where noise is of little concern. If these facilities are located where there is a greater sensitivity to noise, measures would be incorporated into their design to reduce noise impacts.

Tunnel ventilation portals could also be a potential source of noise. Routine ventilation noise can generally be readily controlled to the point where it should have little or no impact within most environments. The noise from emergency ventilation equipment is likely to be noticeable, but will only occur during emergencies and system testing.

Substantial portions of the potential surface and elevated rail alignments under consideration abut noise-sensitive residential land uses. Most of the I-5 alignment between Seattle's Eastlake area and south Snohomish County abuts residential development. The mixed land uses along Martin Luther King, Jr. Way South include residential buildings in close proximity to the roadway.

Rail operations could increase noise and vibration along elevated segments of the alignment. Vibration and noise will vary depending on the placement of the guideway in relation to the surrounding roadway, the acoustic layers and track mountings utilized, and the physical proximity and sensitivity of

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Rail operations could increase noise and vibration along elevated segments of the alignment. Vibration and noise will vary depending on the placement of the guideway in relation to the surrounding roadway, the acoustic layers and track mountings utilized, and the physical proximity and sensitivity of

noise receptors. On potential alignments such as Roosevelt Way North in north Seattle, the physical proximity and sensitivity of abutting residential uses, along with relatively limited background traffic noise, could result in significant noise impacts. Elevated guideways along the outsides of rights-of-way would increase the potential noise impacts on adjacent properties. Guideways located within the medians of roadways would have less noise impact. Where needed, noise barriers and other noise attenuation measures would reduce noise impacts.

Commuter Rail Element

Commuter rail would have an average cruising speed of about 55 to 60 mph along portions of the line within developed areas where there are more at-grade crossings and a top speed of up to 79 mph in suburban or other areas where there are limited at-grade crossings. The maximum pass-by noise level at a distance of 50 feet produced by trains traveling at 55 mph would be 83 dBA. At a speed of 35 mph, the maximum pass-by noise would be 77 dBA.

The noise from commuter rail operations would probably have relatively little impact along the BN alignment between Seattle and Tacoma, given the high speeds and volumes of trains already using the tracks and the relative lack of residential areas or other noise-sensitive receptors. Noise impacts would be greater along the UP alignment segment, which accommodates fewer trains and trains operating at lower speeds than the BN alignment. If the UP alignment is used, jointed rails would be replaced with welded rails to increase speeds and reduce noise.

Because commuter rail operations would be limited to commuting and possibly midday periods, its only potential impact on nighttime noise levels would be between 5 and 7 a.m. Average hourly and all day noise levels would increase, but there would not be an increase in the maximum noise associated with passing trains along the BN alignment. The frequency of train-related noise will increase, especially during the morning and late afternoon commute hours. Whistle noise, which is required at all grade crossings, could also be of concern.

As with noise levels, vibration levels are not expected to increase but the frequency of railroad-related vibration will increase.

3.3.4 Mitigation of Impacts

3.3.4.1 Construction

Possible measures to mitigate construction noise and vibration include:

- Strictly enforce noise ordinance restrictions, including nighttime restrictions.
- Restrict particularly noisy construction operations to avoid sensitive times.
- Require contractors to muffle equipment noise.
- Mandate temporary noise barriers between work zones and sensitive uses.

- Notify nearby land owners prior to periods of unusually loud construction noise.

- Require contractors to prepare approved noise control plans where noise impacts are likely to exceed permitted limits.

- Monitor construction noise levels to ensure compliance with applicable limits.

- Institute a construction "hot line" to handle noise complaints on a timely basis.

- Use construction techniques (such as pile auguring instead of pile driving) to reduce noise and vibration impacts.

- Use passive measures (trenching, sheet piling, and screening) to modify the propagation paths of ground vibrations.

- Monitor vibration levels at sensitive receptors.

3.3.4.2 Operations

The most effective way to reduce operating noise impacts is to select and design alignments and facility sites to avoid major noise impacts. Where possible, avoiding residential areas will reduce impacts. Impacts can also be reduced by using major existing rail or roadway corridors for development of new rail transit operations.

Noise mitigation measures include: reduce noise emissions levels; create barriers between noise sources and sensitive receptors; and change land uses near noise sources. All of these options will be considered during preliminary and final engineering.

Noise can be reduced by using the best available technology and maintenance techniques for a given alternative. Engineering and design can contribute to smoother, quieter guideways and vehicle propulsion, braking, and steering equipment.

Barriers blocking the direct line-of-sight between a noise and sensitive receptors can reduce noise by 8 to 10 dBA. This would bring most noise levels within applicable standards for receptors 50 feet or more from a given source. The need for such measures will be determined in project-level planning. If noise impacts would be unacceptable even after mitigation, affected properties may be acquired or redeveloped with less noise-sensitive uses.

Project-level analysis will examine system components and facility locations where vibration could be a particular concern to determine where more analysis and mitigation may be required. Vibration simulation techniques can be used to evaluate potential vibration impacts. Facilities and equipment can then be designed to achieve appropriate groundborne vibration limits.

3.4 Water Quality and Hydrology

Water quality may be degraded if pollutants from construction or operation of an alternative enter surface or ground water. Regional vehicle miles traveled may also affect water quality by changing the amount of pollutants produced by motor vehicles. Runoff may be increased if impervious surface increases. Flooding may increase if construction reduces floodplain capacity.

3.4.1 Affected Environment

3.4.1.1 Surface Water Drainages and Water Quality

Water Quality Criteria

Washington State classifies water bodies according to required standards, including fecal coliform bacteria, dissolved oxygen, temperature, and pH. New discharges are not allowed to degrade water quality below the standards. Toxic, radioactive, or other deleterious materials may not cause acute or chronic conditions adversely affecting aquatic life or public health.

Class AA, Class A, and Lake Class water bodies are expected to be suitable for all uses, including drinking water. Class B water bodies are unsuitable for drinking water supply and swimming. Class C water bodies are unsuitable for drinking water supply, swimming, and fish or shellfish rearing, spawning, or harvesting.

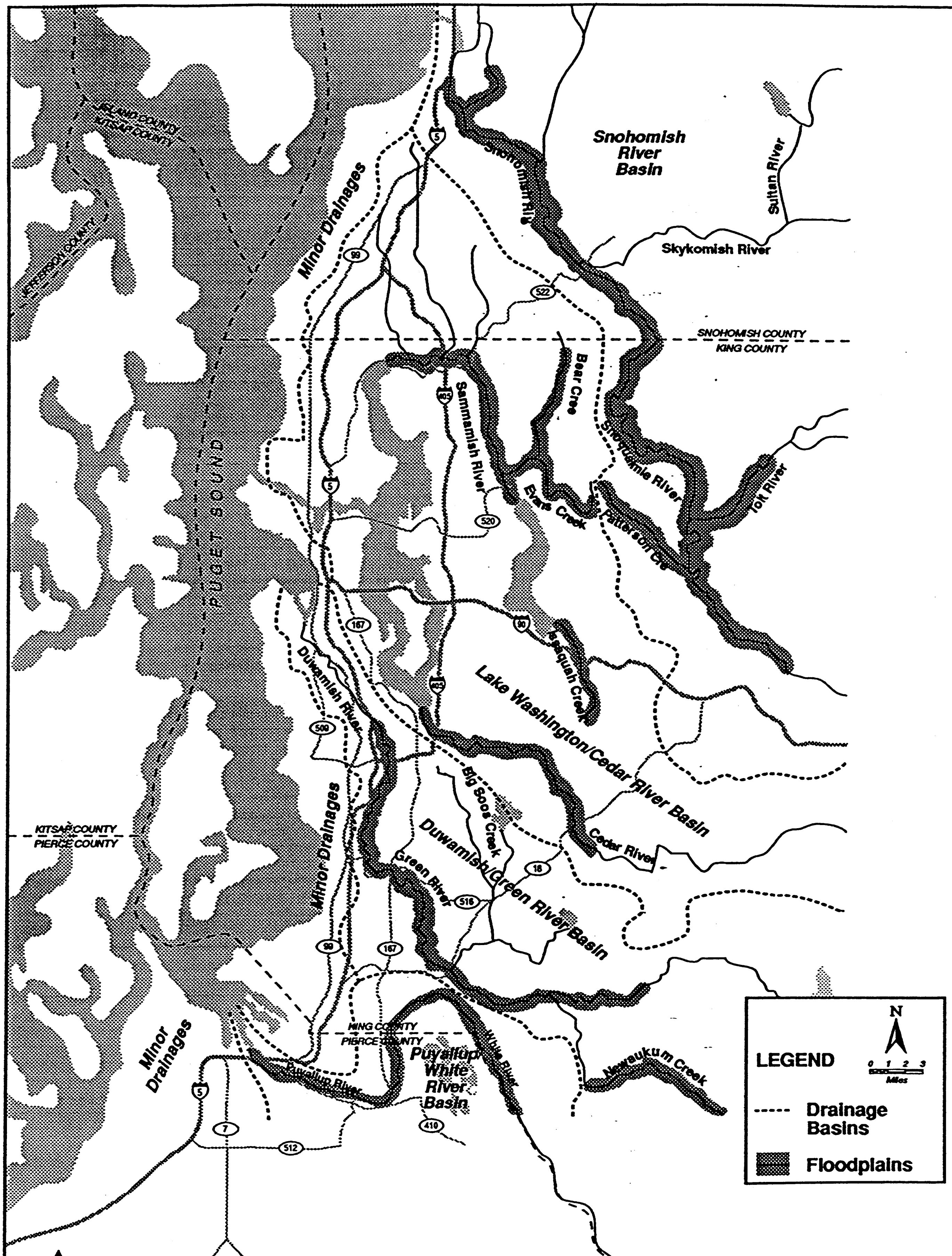
Floodplain Regulations

Federal Executive Order 11988, issued in 1977, established a process for flood hazard evaluation based upon the 100-year base flood standard of the National Flood Insurance Program (NFIP). NFIP sets minimum standards for floodplain management. These minimum standards must be adopted by state and local agencies. The Washington State Department of Ecology has established minimum state requirements for floodplain management and provides oversight and approval of local ordinances. Washington State law requires that local ordinances meet or exceed NFIP requirements. King and Snohomish counties have additional requirements regarding floodplains.

Under these regulations, all proposed activities should be reviewed at the earliest possible stage to determine if they are in a floodplain. In general, development proposals should not reduce the effective base flood storage volume. For a complex project, public notice and review is required. A detailed study may be necessary to identify and quantify all direct and indirect impacts of the proposed action. Alternatives should be examined, including locating activities outside of the floodplain. Containing flood waters, floodproofing, and installing flood warning systems may also be considered. Projected activities and alternatives should be adjusted to minimize adverse environmental impacts, restore previously lost values, and preserve existing values.

Drainage Basins and Floodplains

Four river systems drain the project area (Figure 3.8). Each has areas that are subject to flooding. Major rivers and creeks with significant floodplains include the Puyallup River, the Green River, the Cedar River, Issaquah Creek, the Sammamish River, and the Snohomish River.



Regional Transit Project

KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

Regional Floodplain Areas and Drainage Basins

System Plan EIS

FIGURE 3.8

The Snohomish River Basin covers 1,978 square miles in Snohomish and King counties. Tributaries include the Skykomish and Snoqualmie Rivers. The Snohomish River is designated Class A and generally meets this standard. However, there is contamination from industrial uses in the Snohomish River near Everett.

The Lake Washington/Cedar River Basin covers 600 square miles in King County. The Lake Washington Ship Canal, Lake Union, Lake Washington, and Lake Sammamish are designated Lake Class and generally meet this standard. The Cedar River is designated Class A and meets those criteria. The Sammamish River is designated Class AA, but sometimes exceeds each of the criteria. Metal concentrations in the basin are generally less than EPA criteria for harm to aquatic life. Most tributaries of the system are designated Class AA, but their actual water quality ranges from fair to good, with most of them sometimes exceeding fecal coliform, temperature, and dissolved oxygen criteria, and some have problems with copper, zinc, and iron contamination.

The Duwamish/Green River Basin covers 470 square miles in King County. The Duwamish River is designated Class B, but fecal coliform counts sometimes exceed this criterion. The river has a history of high metal and organic compound concentrations from industrial uses, often exceeding levels harmful to aquatic life. Sediments in the lower Duwamish are contaminated with metals and organic chemicals. The Green River is designated Class A, but sometimes exceeds the fecal coliform, dissolved oxygen, and temperature standards. The water quality has been improving since sewage treatment plant effluent was stopped from being discharged into the river.

The Puyallup/White River Basin drains 1,464 square miles of Pierce and King counties. The Puyallup River is designated Class B for the its first mile and, along with the White River, is designated Class A upstream. Fecal coliform levels sometimes exceed the standards. Turbidity standards are also exceeded in the summer, due to glacial runoff. Cadmium, copper, lead, and zinc concentrations in the Puyallup River sometimes exceed state water quality criteria (Parametrix 1989; Ebbert 1987).

Many *smaller streams*, including Chambers, Wapato, Hylebos, Des Moines, Miller, Salmon, Longfellow, Pipers, Boeing, and Pigeon creeks, flow directly into Puget Sound. Data on stream water quality is incomplete in many cases. Some streams are relatively uncontaminated; others have problems with fecal coliform bacteria, nutrients, heavy metals, and organic chemicals. Because of their size, these streams are particularly susceptible to contamination (Metro 1990a).

Stormwater

The discharge of urban stormwater to the environment causes physical, chemical, and biological degradation of local lakes and streams and Puget Sound. Stormwater often contains high levels of nutrients, leading to increased algal growth and lowered oxygen levels in lakes; high levels of fecal coliform bacteria; and high levels of heavy metals and hydrocarbons from roadways and parking lots (Hubbard 1989).

In the early 1980s, Metro began an intensive program to reduce contaminated runoff from its transit facilities, which included installing state-of-the-art oil-water separators, enlarging detention facilities, removing contaminat-

ed soils, replacing leaking underground storage tanks, monitoring compliance full time, and strengthening training. Advances continue to be made, including using new, nontoxic detergents to wash buses.

3.4.1.2 Groundwater Resources

Groundwater is found at relatively shallow depths in the project area, typically 25 to 50 feet below ground level. Principal aquifers consist of glacial drift or alluvium, with depths to water of 25 to 50 feet in the glacial drift and less than 25 feet in alluvial aquifers. Alluvial aquifers are found along the principal rivers in the region.

In most areas, groundwater quality meets drinking water standards. The most common water quality problems are high iron and manganese concentrations. Groundwater in some areas, such as Superfund sites, has been contaminated with heavy metals, hydrocarbons, solvents or other toxic pollutants.

The City of Renton's sole source aquifer consists of coarse-grained alluvial and deltaic deposits near the mouth of the Cedar River. The aquifer protection area extends generally south and east from the city's well field near the center of Renton. The City of Issaquah's drinking water aquifer has several recharge areas, including an area directly beneath downtown Issaquah.

3.4.2 Construction Impacts

3.4.2.1 No-Build Alternative

No significant water quality impacts from construction are expected under this alternative.

3.4.2.2 TSM Alternative

Construction of park-and-rides and HOV facilities would expose soils for site preparation, grading, excavation, and filling, increasing the potential for erosion and sedimentation. This would be particularly noticeable in smaller drainages. Heavy equipment operation and refueling in construction areas would also increase the potential for oil and fuel spills entering surface runoff and groundwater. Excavation of sites for multilevel park-and-rides might require dewatering in areas where groundwater is near the surface, which could temporarily affect water levels in nearby wells.

3.4.2.3 Transitway/TSM Alternative

Construction impacts of the Transitway/TSM Alternative would be similar to those of the TSM Alternative. In addition, dewatering for minor tunneling could cause temporary lowering of groundwater levels near tunneling sites.

3.4.2.4 Rail/TSM Alternative

Most construction impacts from this alternative would be similar to but greater than the TSM and Transitway/TSM Alternatives, due to the increased scale of construction.

Tunnel construction site dewatering, permanent or long-term structure dewatering, and permanent subsurface structures may have a long-term impact on groundwater flow patterns. Continuous dewatering and/or

permanent tunnel structures may cause a barrier effect. This effect, however, would be directly related to the configuration of the tunnel with respect to the geologic and hydrogeologic setting. For example, if the tunnel was constructed above an aquifer water table, the flow pattern would probably not be interrupted. However, if the tunnel was constructed perpendicular to the groundwater flow direction, and at or below aquifer groundwater levels, flow patterns could be interrupted. Impacts of each tunnel would be assessed during project-level environmental review.

North Corridor

Capitol Hill Alignment. Dewatering may be necessary to carry out the extensive tunneling proposed for this alternative, creating localized depressions in water tables. After construction, water levels would likely return to preconstruction levels.

I-5 Alignment. This alternative involves extensive tunneling between the Convention Place Station and Mercer Street and north of NE 42nd Street. This could have temporary impacts on groundwater levels.

South Corridor

The Rail/TSM Alternative could require new bridges over the Duwamish, Puyallup and Cedar Rivers. Construction could cause temporary increases in suspended sediments in these rivers. Stirring up contaminated sediments in the Duwamish River could release toxic chemicals into the water. The sole source aquifer in Renton could be affected by construction of the rail line in that area.

Rainier Valley Alignment. This alignment could involve extensive tunneling, with possible temporary effects on local groundwater levels.

Commuter Rail Element. Construction of commuter rail stations could require work near the Green River. Both railroad rights-of-way cross the Green River in Kent, the Burlington Northern at approximately South 269th Street and the Union Pacific's at approximately South 259th Street. The BN also crosses the White River in the City of Pacific and the UP crosses the Puyallup River near I-5 in Tacoma. None of the potential station sites are located adjacent to any surface water bodies. Short-term construction impacts on water quality will also occur due to erosion and sediment runoff and dust emissions.

East Corridor

Dewatering necessary for tunneling through downtown Bellevue would temporarily lower groundwater levels. Tunneling under Bellevue Way, if that alignment was chosen, would have temporary local effects on groundwater levels, but no permanent impacts. The alternative would require bridges over the Sammamish River at Redmond and Bothell, which could temporarily increase suspended sediments there. Bridging Mercer Slough for the I-405/BNRR alignment would have similar impacts. The alignment would probably cross Issaquah's aquifer recharge area.

3.4.3 Operations Impacts

Impervious surface was estimated conservatively by assuming new rights-of-way were unpaved before acquisition. Heavy metals (lead, zinc, etc.) and

organic compounds are pollutants commonly found in urban runoff, including highways and parking lots. In general, these pollutants increase with the number of vehicle miles traveled (VMT). Nutrient or pesticide runoff from newly landscaped areas are other pollutant sources. Nutrients, such as nitrates or phosphates, accelerate algae production in lakes. Winter sanding of roadways and parking lots, vehicle leaks, and accidental spills are also potential pollution sources.

3.4.3.1 No-Build Alternative

No significant changes in stormwater runoff quantities in the region would be expected because of the project. New roads and highways built in the region by other agencies, however, would increase total stormwater runoff. Increases in regional VMT would increase stormwater runoff pollutants. Total suspended solids, chemical oxygen demand, nitrogen, nitrates, nitrites, phosphorus, zinc, copper, and organic contaminants would be expected to increase. Impacts on groundwater quality could result if dissolved pollutants migrate to the water table.

3.4.3.2 TSM Alternative

Completion of TSM capital improvements would result in a permanent increase in impervious surface in the region of approximately 374 acres (Table 3.4.1), resulting in a total increase in surface runoff of approximately 48 acre-feet during the greatest storm of 24-hour duration that would be likely to occur over a period of 25 years. This increase in runoff would be insignificant on a regional scale. However, increases in impervious surface could have a significant effect on smaller drainages. Since no construction is expected in floodplains, no regional effect on flood elevations is anticipated.

Table 3.4.1. Estimated Increases in Surface Runoff from the Build Alternatives for a 24-Hour, 25-Year Storm.

Corridor	Alternative	Affected Area (Acres)	Predevelopment Runoff (Acre-Feet)	Postdevelopment Runoff (Acre-Feet)
North	TSM	175	18	38
	Transitway/TSM	176	18	38
	Rail/TSM	377	38	81
South	TSM	129	17	35
	Transitway/TSM	212	27	58
	Rail/TSM	277	35	76
East	TSM	70	10	20
	Transitway/TSM	94	13	27
	Rail/TSM	367	50	107
Total	No-Build			
	TSM	374	45	93
	Transitway/TSM	482	58	123
	Rail/TSM	1,021	123	264

Source: Acreages from Metro; runoff calculations from Boateng (1991).

The effect of bus service increases on stormwater runoff quality would be insignificant and offset by the reduction in vehicle miles traveled, as

compared to the No-Build Alternative. A much greater effect on water quality would result from a net increase in vehicle miles traveled in the region. Total suspended solids, chemical oxygen demand, nitrogen, nitrates, nitrites, and phosphorus would be expected to increase. Zinc, copper, and organic contaminants would also increase. Impacts on groundwater could result if water containing dissolved pollutants migrates to the water table. The degree to which these pollutants affect regional water bodies depends on the design of roadway stormwater detention and filtering systems.

More localized effects on water quality could be caused by increased landscaping, as well as increased roadway surface requiring winter sanding, as compared to the No-Build Alternative.

3.4.3.3 Transitway/TSM Alternative

The Transitway/TSM Alternative would increase impervious surface by about 482 acres, leading to an increase of runoff of about 68 acre-feet during the 25-year storm of 24-hour duration (Table 3.4.1). This increase would have an insignificant effect on a regional scale. However, increases in runoff could have a significant effect on stormwater in smaller drainages. Since no construction is expected in floodplains, no regional effects on flood elevations would be anticipated.

Vehicle miles traveled would be less than under the No-Build Alternative. However, increased population and other factors will cause a net increase in VMT from 1990. This will increase stormwater runoff pollutants such as total suspended solids, chemical oxygen demand, nitrogen, nitrates, nitrites, phosphorus, zinc, copper and organic contaminants. Water quality could be affected by slightly increased landscaping under this alternative, as well as slightly increased roadway surface requiring winter sanding, as compared to the TSM Alternative.

3.4.3.4 Rail/TSM Alternative

The Rail/TSM Alternative would increase impervious surface by about 1,021 acres, leading to an increase of runoff by 141 acre-feet during the 25-year storm of 24-hour duration (Table 3.4.1). Much of this increase would be due to the increased numbers of park-and-ride spaces proposed for this alternative. The increase would be insignificant on a regional scale. However, increased runoff could have a significant effect on storm runoff in smaller drainages and on some small drainages crossed by rail lines. Bridges and culverts would be designed to minimize impacts on flood capacity and would be unlikely to restrict the passage of floodwaters.

The effect of increases in bus service would be insignificant and offset by the reduction in vehicle miles traveled as compared to the No-Build Alternative. However, overall vehicle miles traveled would still increase as compared to 1990, increasing total suspended solids, chemical oxygen demand, nitrogen, nitrates, nitrites, phosphorus, zinc, and copper in runoff. Groundwater quality could be degraded if water containing pollutants reaches the water table. More localized water quality impacts could be caused by increased landscaping under this alternative, as well as increased roadway surface requiring winter sanding.

Commuter Rail Element

Stations and park-and-ride lots will have some impact on surface water quality because the increased impervious surface area will result in increased surface-water runoff.

3.4.4 Mitigation of Impacts

3.4.4.1 Construction

Construction will meet all applicable requirements for controlling runoff and limiting erosion. Water quality impacts during construction would be substantially reduced or eliminated by implementing mitigation measures to control erosion and sedimentation and to stabilize exposed soils. Surface runoff could be diverted or conveyed through construction sites to prevent it from eroding the site and becoming contaminated by sediment. Runoff could be directed over vegetated watercourses, through sedimentation ponds, or through sediment barriers before reaching receiving waters. Check dams could be installed on steeper slopes to prevent excessive flows. Disturbed earth should be planted, mulched, or covered as soon as practical.

To prevent water pollution from spills, contractors would implement a Spill Prevention, Control and Countermeasures Plan in accordance with EPA regulations. Impacts of spills could be reduced by berming tanks and refueling areas and locating them away from surface water bodies and by diverting surface runoff to detention ponds.

Impacts from building bridges or other structures across water bodies could be minimized by use of dredging and transport methods that reduce the amount of sediment resuspended or lost and the use of silt curtains and cofferdams to contain resuspended sediment in the immediate dredging area.

If practical, the use of tunnel construction techniques not requiring dewatering could be used. If dewatering is required, any affected well owners could be supplied with alternate water sources.

3.4.4.2 Operation

The scale of increases in impervious surfaces could possibly be reduced by increasing feeder bus service to park-and-ride lots, reducing the need for more spaces. This might, however, have a negative impact in terms of ridership and increase vehicle miles traveled. The tradeoff would be evaluated during project-level planning.

Effects of increased runoff from impervious surfaces would be mitigated by including detention ponds or permeable infiltration galleries or ponds in the design of facilities. Peak rates of runoff would be limited to pre-development peak rates for specific design storms. Biofiltration measures would be used to control water quality of stormwater runoff to predevelopment levels. To minimize impacts on floodplains, any structures crossing these areas would be designed to minimize obstruction of flow and to maintain the effective storage capacity of the floodplain.

Use of oil/water separators, sediment ponds, and grassy swales at transit facilities would reduce the potential for polluting surface water. Holding basins would minimize the effects of accidental spills where waters are adjacent to roadways or park-and-ride lots. Use of a pickup sweeper and

vacuuming or pumping sand and silt from catch basins would reduce sedimentation from winter sanding. A nutrient and pesticide management program could lessen runoff of these pollutants.

3.5 Ecosystems

3.5.1 Affected Environment

The study area contains rivers, creeks, and large wetlands, such as Mercer Slough/Kelsey Creek and Swamp Creek, that provide substantial wildlife habitat (Figure 3.9). A number of jurisdictions require preservation of trees where sensitive areas and unstable soils exist. Substantial greenbelts are found in association with parks, wetlands, cemeteries, golf courses, and areas with steep slopes. Common wildlife species in natural open spaces include deer, raccoons, skunks, rabbits, squirrels, mice, turtles, snakes, and birds. Important aquatic species include game fish such as trout, steelhead, sturgeon, and salmon.

The Washington Department of Natural Resources' Natural Heritage Program lists three species of threatened or sensitive plants in the project area: the white-top aster, the tall bugbane, and the choriso bog-orchid. Four sensitive habitats, including high intertidal, low salinity marsh; low intertidal, low salinity, silty marsh; surge plain wetland; and transition zone wetland, were also listed (Norwood 1991a,b).

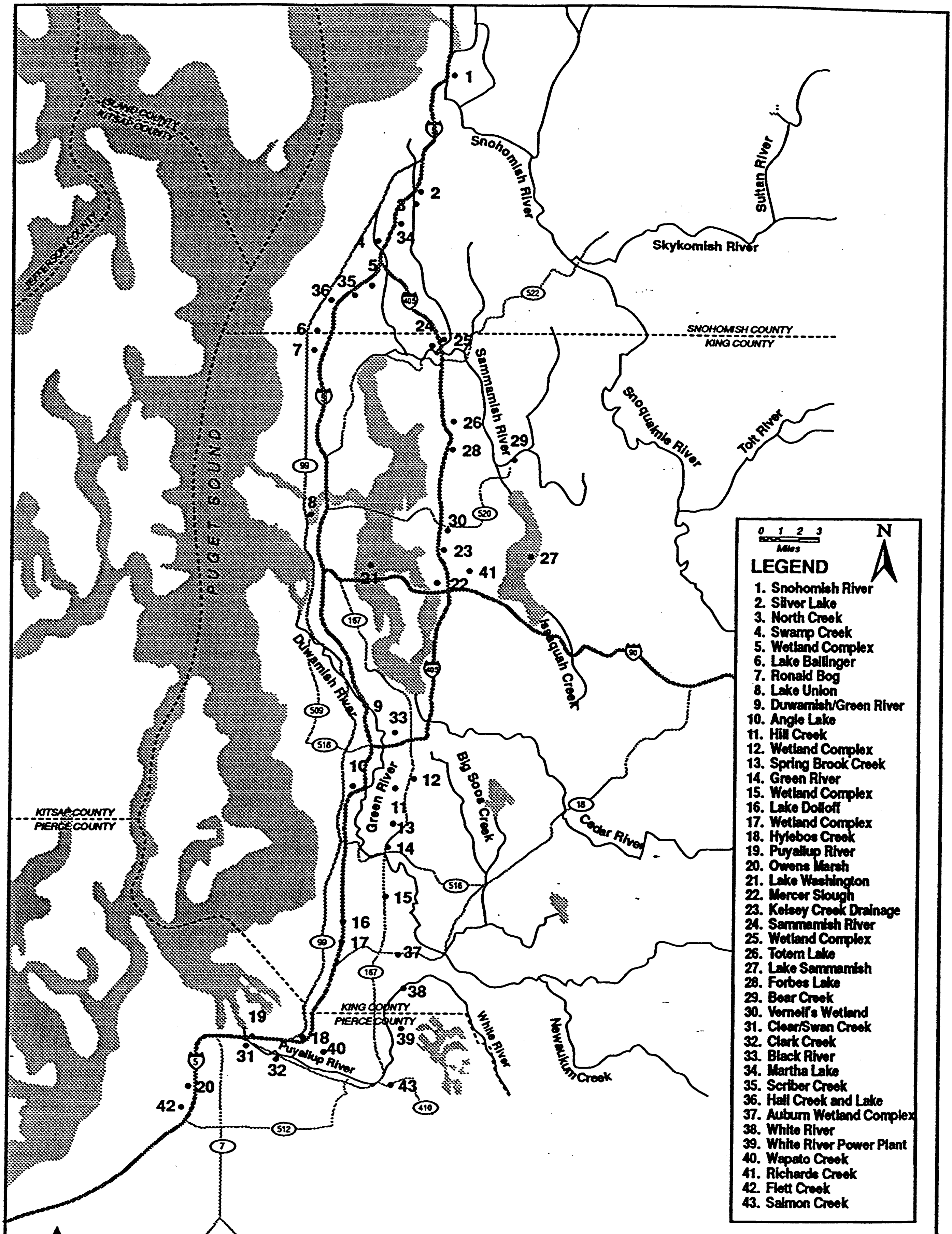
The Washington Department of Wildlife Nongame Wildlife Program lists seven threatened or sensitive species in the project area: the great blue heron, green-backed heron, bald eagle, snowy owl, western bluebird, purple martin, and western pond turtle (Cyra 1990,1991). Other sensitive species in the project area include the common loon, northern goshawk, and pileated woodpecker.

3.5.2 Construction Impacts

Construction impacts would be similar for each alternative but may differ in extent of impact. Wetlands, woodlands, and other fish and wildlife habitats could be degraded or lost due to direct intrusion and removal of vegetation. Some park-and-ride lots could have significant impacts if they are sited on undeveloped land in suburban areas.

3.5.2.1 No-Build Alternative

Temporary habitat disturbance and permanent habitat loss could result from planned park-and-ride expansions, depending on location. Projects would be designed to minimize impacts on critical or sensitive resources. Overall ecosystem quality may be reduced through direct intrusion, habitat removal, increased runoff, erosion, sedimentation, noise, dust, and pollutants. Regional impacts would be minimal.



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Location of Major Wetlands, Lakes and Streams Near Rapid Transit Alignments

System Plan EIS

FIGURE 3.9

3.5.2.2 TSM Alternative

Construction of park-and-ride lots, HOV lanes (for example, at the Swamp Creek interchange), and associated facilities could permanently remove some habitat and temporarily disturb adjacent habitat. Direct intrusion, removal of vegetation and habitat, increased runoff, erosion, sedimentation, noise, dust, and pollutants may reduce the overall quality of adjacent ecosystems.

3.5.2.3 Transitway/TSM Alternative

The effects of the Transitway/TSM Alternative on ecosystems would be similar to the effects of the TSM Alternative, with the exception of the busway between Bellevue and SR-520, which could affect the quality of adjacent high-quality wetlands.

3.5.2.4 Rail/TSM Alternative

New rail alignments, stations, and access facilities may substantially affect access, usability, and water quality of affected ecosystems through direct intrusion, removal of vegetation and habitat, increased runoff, erosion, sedimentation, noise, dust, and pollutants. Some wildlife species sensitive to human activity would die or move to more remote habitats.

Major ecosystems potentially affected by construction of rail lines include Swamp Creek, the Duwamish River, the Puyallup River, the Cedar River, Hylebos Creek, Mercer Slough, Kelsey Creek, and the Sammamish River. In addition, the rail line could require elimination of a number of large trees along some freeway corridors, such as I-5 in Snohomish County, with some loss of habitat for birds and small mammals.

Commuter Rail Element

The original construction of rail embankments in the Green River and Puyallup River valleys disrupted the natural drainage systems to form wetlands along the rights-of-way. Construction of additional tracks for commuter rail may affect these wetlands, particularly if the Union Pacific line is chosen. Some station sites under consideration, including Boeing Longacres and north Auburn, may also be in or adjacent to wetlands. Existing vegetation and wildlife habitat may be disrupted or destroyed by the construction of some stations and/or park-and-rides. No endangered or threatened species are expected to be affected by construction.

3.5.3 Operations Impacts

Operations impacts could result where new facilities are adjacent to high quality ecosystems. Noise, traffic, pollution, loss of access, and human activity from new park-and-ride lots under the TSM, Transitway/TSM, and Rail/TSM Alternatives, as well as tracks, wires, and associated structures for the Rail/TSM Alternative could increase stress on plant and wildlife populations and lead to reduction in numbers or changes in species distribution. The most serious potential impacts would be where the Rail/TSM Alternative crosses major ecosystems such as wetlands and rivers. The No-Build Alternative would have little direct impact on ecosystems other than localized impacts near some expanded park-and-ride lots. Indirectly, this alternative may encourage greater sprawl, contributing to habitat loss on the urban fringe. In contrast, the build alternatives are

supportive of a pattern of regulated land use that will facilitate protection and preservation of significant ecosystems in the region.

Commuter Rail Element

Operation of the commuter rail line is not expected to have adverse impacts on ecosystems.

3.5.4 Mitigation of Impacts

3.5.4.1 Federal Regulatory Constraints

Section 4(f) of the Department of Transportation Act (49 U.S.C. 303) requires that no prudent and feasible alternative exist to any federal action using properties covered by the act and that all possible planning has been done to minimize harm. Subject properties include significant publicly-owned parks, recreation areas, open spaces, and wildlife and waterfowl refuges. Steps to complete Section 4(f) include:

- o Identifying potentially affected properties
- o Analyzing potential direct and indirect impacts
- o Examining alignment variations and design alternatives that might avoid impacts
- o Identifying measures to mitigate impacts if design variations prove infeasible.

Section 404 of the Clean Water Act (32 U.S.C. 1344) is used to determine whether discharges of material to surface water (including filling for rights-of-way) are permitted. Under Section 404 and related regulations (40 C.F.R. 230), four conditions must be satisfied:

- o There can be no practicable alternative to the discharge which would have less impact on the aquatic ecosystem, unless that alternative has other significant adverse impacts.
- o The discharge cannot violate state water quality or toxic effluent standards, the Clean Water Act Section 307, the Endangered Species Act, or the Marine Protection, Research, and Sanctuaries Act.
- o No discharge of dredged or fill material can cause or contribute to significant degradation of the waters of the United States.
- o All appropriate and practicable steps have been taken to minimize potential adverse impacts on the aquatic ecosystem.

The preferred build alternative will comply with Section 4(f), Section 404, and other applicable regulatory processes.

3.5.4.2 Specific Mitigation of Impacts

Facilities and alignments could be relocated, lowered below grade, or elevated above grade to minimize impacts to important ecosystems. Construction techniques should minimize impacts to access and usability of ecosystems. Earth berms, barriers, vegetative screening, and temporary hydroseeding of exposed soils would also minimize impacts. Where feasible, facilities should incorporate significant landscape features and vegetation into site design. Mitigation should aim to replace any lost wetland functions and values.

While avoidance is the best mitigation, wetland enhancement, replacement, or creation, in that order, could be used where impacts are unavoidable.

RTP would coordinate and comply with sensitive areas regulations of local jurisdictions in construction and operation of system plan alternatives.

3.6 Energy

Automobiles, buses, and rail vehicles are the major transportation energy consumers within the region. Energy is also required to build transportation facilities.

3.6.1 Affected Environment

Average energy consumption of transit and automobiles is shown in Figure 3.10. Because transit vehicles and automobiles have different passenger capacities, a more meaningful way to compare each mode is by energy consumption per passenger mile (Table 3.6.1 and Figure 3.11). These figures represent the current energy efficiency of the vehicles, not their potential energy efficiencies or the projected energy efficiency of the System Plan. Substantially greater energy efficiency can be achieved by public transit than automobiles when seats are filled. The actual energy efficiency decreases when vehicles have passenger loads below capacity or must deadhead between passenger pick-up points.

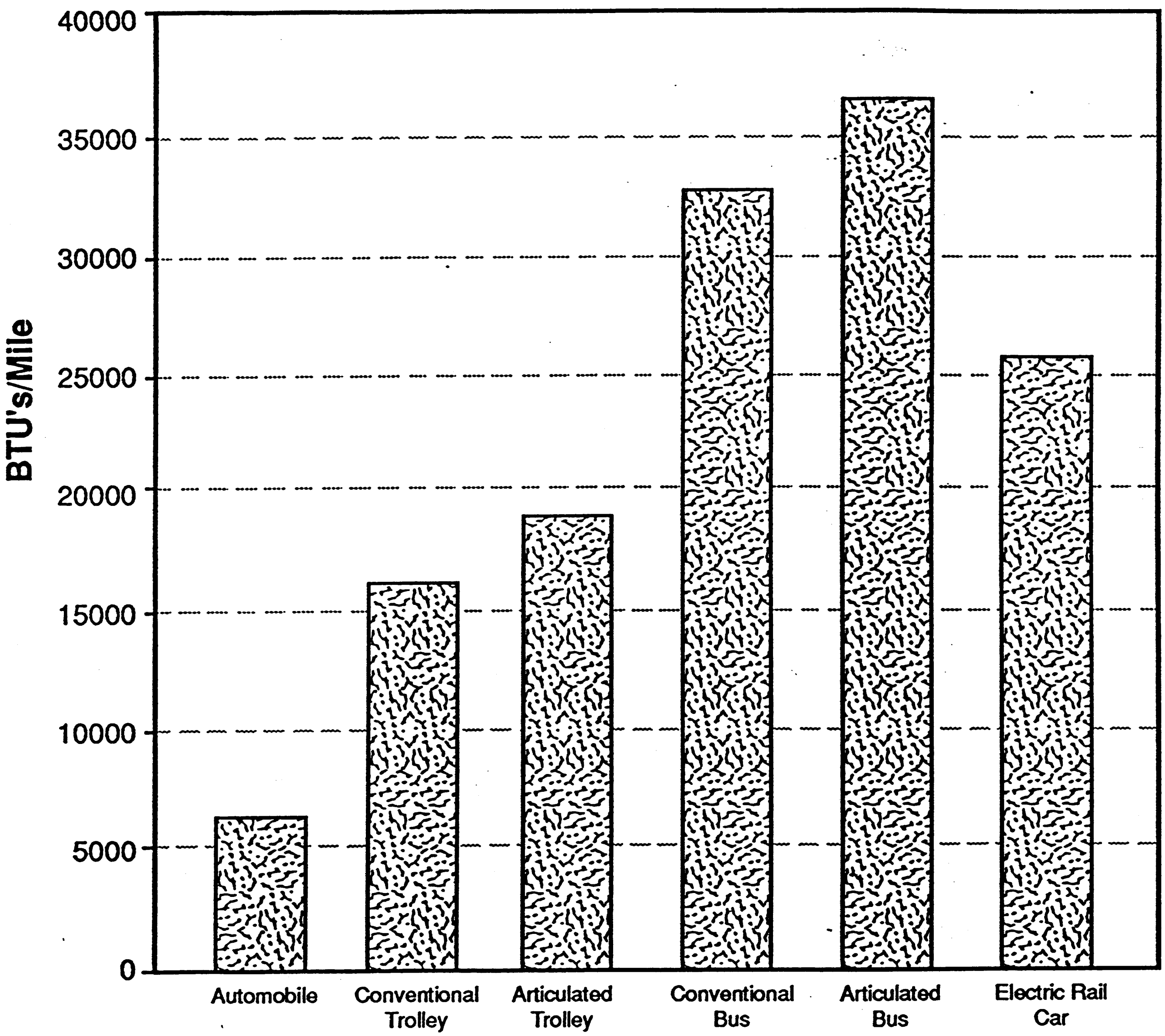
Table 3.6.1. BTUs per Passenger Mile.

Vehicle	BTUs/ Vehicle Mile	BTUs/ Seat Mile	BTUs/ Passenger Mile*
40' Bus	33,200	755	3,775
60' Bus	36,400	520	2,600
40' Trolley	15,900	353	1,360
60' Trolley	19,200	300	1,150
Dual-Power	36,400	578	2,890
Automobile	6,200	1,550	5,170
Rapid Rail	31,700	439	N.A.
Commuter Rail	350,000	389	N.A.

*Based on current average automobile occupancy of 1.2 persons and current average Metro loading for diesel and trolley buses. Rapid rail and commuter rail BTUs/Passenger Mile not shown, since these modes do not currently operate in the 3-county region.

Source: BRW 1991d, Metro.

Comparing estimated regional energy consumption for transit and automobiles shows that transit use is less than 2 percent of total regional transportation energy consumption (Table 3.6.2).



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Average Energy Consumption by Mode

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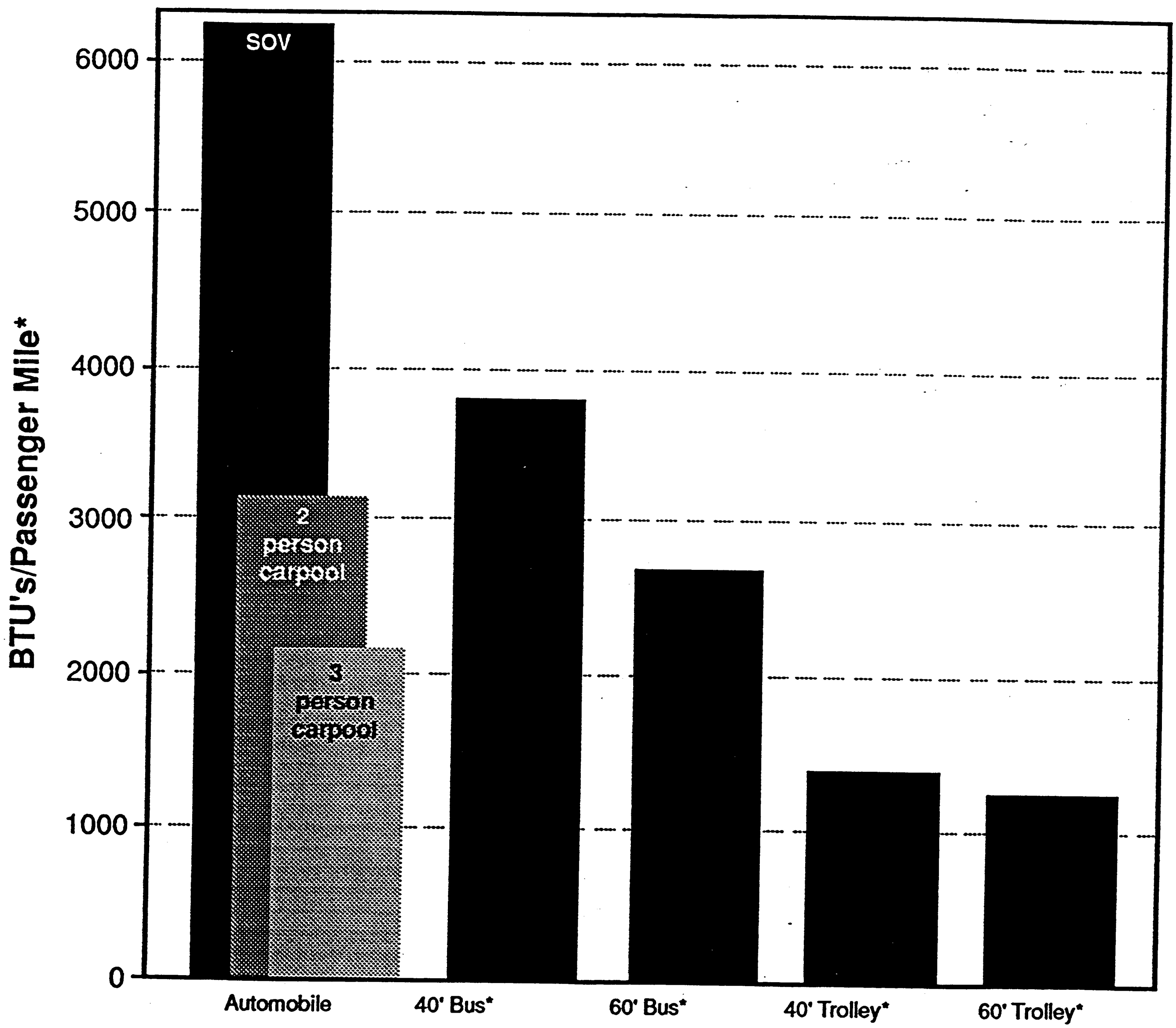
FIGURE 3.10



* At current average Metro passenger loads.

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Current Average Energy Consumption per Passenger Mile

System Plan EIS

FIGURE 3.11

Table 3.6.2. Estimated Annual Regional Transportation Energy Consumption.

	Gasoline or diesel (millions of gallons)	Electricity (million kwh)	BTUs (trillions)
Transit	14	17	2
Automobiles	860	-	107

Source: PSCOG 1990; Metro staff.

3.6.2 Construction Impacts

Under all alternatives, including the commuter rail element of the Rail/TSM Alternative, increases in fuel consumption due to construction would be minor and would not have a significant impact on fuel availability.

Construction energy costs were estimated based on typical energy consumption for highway widening, track construction, tunneling, and building of structures, electric substations, signals, stations, parking, and maintenance facilities (Table 3.6.3). Construction energy consumption was weighed against operations energy savings to estimate a payback period for construction energy consumption. The payback period is the approximate length of time required for construction energy consumption (as compared to the No-Build Alternative) to be balanced by operations energy savings. For the purposes of estimation, it was assumed that annual operational energy savings would be equal to 2020 energy savings.

Table 3.6.3. Construction Energy Consumption and Payback Period.

Alternative	Construction Energy Consumption (Trillion BTUs)	Net Change from No-Build (Trillion BTUs)	Annual Operation Energy Savings (Trillion BTUs)	Payback Period (years)
No-Build	2.5	-	-	-
TSM	31.7	29.2	1.7	17.2
Transitway/TSM	39.5	37.0	1.8	20.6
Rail/TSM	51.8	49.3	5.2	9.5

Construction energy consumption would be highest for the Rail/TSM Alternative at more than 50 trillion BTUs. The Transitway/TSM Alternative would consume about 40 trillion BTUs, while the TSM Alternative would consume about 32 trillion BTUs. The minor construction proposed under the No-Build Alternative would consume only 2.5 trillion BTUs. Because of increased energy savings from operation of the Rail/TSM Alternative (due to higher ridership and lower automobile usage), the payback period for the Rail/TSM Alternative would only be about 10 years, as compared to almost 20 years for the TSM and Transitway/TSM Alternatives.

3.6.3 Operations Impacts

By 2020, the nonelectric transit fleet would use an alternate fuel such as compressed natural gas or clean diesel (Voris 1991). Estimates of automobile energy consumption are based on the assumption that automobiles

would continue to use nonrenewable fuels for power. The estimates are based on current energy efficiencies of transit vehicles and automobiles; actual energy consumption would depend on future energy efficiency changes. While the overall energy efficiency of vehicles will probably increase by 2020, the actual energy efficiency of automobiles and buses in traffic may decrease as congestion increases and forces longer periods of idling and slower speeds. Under these conditions, the relative energy benefits of the build alternatives will probably increase to the extent that they reduce vehicle miles traveled. In addition, the build alternatives, particularly the Rail/TSM Alternative, will encourage a more concentrated pattern of land use which should further reduce vehicle miles traveled and increase efficient energy use.

Under all alternatives, portions of the transit system would be powered by electric rather than combustion engines, with the greatest electric use occurring under the Rail/TSM Alternative. To the extent that electric power is produced from renewable resources (e.g., hydropower, conservation, wind power), increases in electric consumption may represent increasing use of renewable resources rather than dependence on nonrenewable resources. However, because the mix of power sources in the year 2020 is difficult to forecast, no attempt was made to analyze use of renewable and nonrenewable energy sources.

Energy production and transmission, as well as consumption, have impacts on air quality, water quality and availability, fisheries, wildlife habitat, vegetation, and environmental health. Because the build alternatives would reduce demand for combustion fuels and would not significantly increase regional demand for electric power, it was not considered necessary to analyze these indirect impacts of the project.

3.6.3.1 No-Build Alternative

For the transit fleet alone, the No-Build Alternative would consume about 1.9 trillion BTUs of energy, including 17 million kwh of electricity, a year, or about 2,270 BTUs per passenger mile (Table 3.6.4). Regional automobile fuel consumption would be about 191 trillion BTUs a year.

Table 3.6.4. 2020 Estimated Transportation Energy Consumption (Trillion BTUs).

Alternative	Transit	Automobiles	Total	Net Change from No-Build
No-Build	1.9	190.7	192.6	-
TSM	3.4	187.5	190.9	-1.7 (-0.9%)
Transitway/TSM	3.5	187.2	190.8	-1.8 (-0.9%)
Rail/TSM	3.8	183.7	187.4	-5.2 (-2.7%)

3.6.3.2 TSM Alternative

In 2020, the transit fleet would consume about 3.4 trillion BTUs of energy, including 35 million kwh of electricity, about double that of the No-Build fleet, or about 3,040 BTUs per passenger mile. Additional electricity would be used for park-and-ride and maintenance facilities and on-line freeway stations.

Automobile energy consumption would be about 3.2 million BTUs less per year than under the No-Build Alternative. The decrease in automobile energy use would more than offset the increase in transit energy use, for a net decrease of 1.7 trillion BTUs per year.

3.6.3.3 Transitway/TSM Alternative

In 2020, the transit system would use about 3.5 trillion BTUs per year, including 39 million kwh of electricity, or about 3,090 BTUs per passenger mile. In comparison, regional automobile consumption would be about 3.5 trillion BTUs less than under the No-Build Alternative. The decrease in automobile energy consumption outweighs the increase in transit energy consumption, for a net decrease of 1.8 trillion BTUs.

3.6.3.4 Rail/TSM Alternative

The proposed rail system would use about 9.0 kwh per mile traveled by a rail car (Manuel Padron 1992). In 2020, the system would require about 296 million kwh per year to operate and an additional 37 to 49 million kwh for station operation. Total annual consumption would be between 333 million and 345 million kwh. Trolley and streetcar service would require an additional 27 million kwh. Total annual energy consumption, including the remainder of the transit fleet and commuter rail, would be about 3.8 trillion BTUs. The bus portion of the alternative would consume about 4,200 BTUs per passenger mile; the rail system (not including station energy needs) would consume about 1,340 BTUs per passenger mile, and the commuter rail line would consume about 2,390 BTUs per passenger mile. Average energy consumption of the whole system would be about 2,600 BTUs per passenger mile.

Energy consumption of the I-5 alignment would be about 7 million kwh per year higher than the recommended Capitol Hill alignment, due to requirements for a University District people mover. The energy consumption of the Martin Luther King, Jr. alignment would be about 6 million kwh per year and the Rainier Avenue alignment about 8 million kwh per year higher than the Marginal Way alignment, due to the greater length of the system, and, in the case of Rainier Avenue, a larger number of underground stations.

In 2020, regional automobile energy consumption would be about 7.0 trillion BTUs less under the Rail/TSM Alternative than under the No-Build Alternative, resulting in a net decrease of 5.2 trillion BTUs.

The increase in electricity consumption under the Rail/TSM Alternative would not significantly affect regional power supply (Moorman 1992). Peak hour requirements of the rail system would be less than 1 percent of extreme peak energy loads. At the present, the Bonneville Power Administration is evaluating options for meeting increased average and peak electricity demand in the region. By 2010, increased electricity demand could be met through a combination of conservation and efficiency improvements, thermal power plants, cogeneration, and renewable energy (BPA 1992b). Peak hour demands could be met through accelerated conservation programs and capital facilities to improve reliability of electric transmission from Eastern Washington (BPA 1992a). However, increased electric usage may require upgrading existing electrical distribution and transmission infrastructure. This impact would be evaluated further during project-level planning.

Commuter Rail Element

Fuel consumption by commuter rail would be about 230 billion BTUs in 2020. Commuter rail can be more energy efficient per passenger than SOVs and most buses. Although diesel-powered trains are the proposed technology, it may be possible in the future to use natural-gas-powered trains on the commuter rail line.

3.6.4 Mitigation of Impacts

Any of the build alternatives would result in a reduction of regional energy consumption. Increases in electrical consumption would be insignificant in terms of regional consumption (less than half of one percent). To mitigate impacts on local electric utilities, the RTP will evaluate energy conservation, energy efficiency, and load management measures as part of project-level planning of facilities, as well as exploring ways to share new rights-of-ways with electric utilities.

3.7 Environmental Health

The alternatives may use sites containing hazardous materials. People excavating contaminated soils, coming in contact with contaminated groundwater, and living near construction areas are the most likely to be affected. In addition, electromagnetic fields (EMFs) and air pollution from project construction and operation could have public health impacts.

3.7.1 Affected Environment

3.7.1.1 Toxic and Hazardous Materials

For a human health risk to exist, two components must be present:

- Toxicity or hazard - the potential for a substance to cause an adverse health impact (e.g., cancer)
- Exposure - the potential for someone to come into contact with the hazardous material.

Sources and Types

The following are examples of land uses that are potential sources of hazardous materials, with the type of materials shown in parentheses:

- Vehicle-related business, such as gasoline stations, oil-change facilities, and vehicle repair and maintenance facilities, (gasoline, diesel fuel, paints, solvents, oils)
- Light industry, such as machine shops (solvents), storage yards, and electrical parts manufacturers (solvents, PCBs), boat builders and repairers (fuels, oils, solvents, resins), and metal finishers and platers (heavy metals, solvents)

- Heavy industry, such as fuel and chemical distribution and storage, railroad facilities, and steel mills (fuels, oils, solvents, metals)
- Other land uses, such as dry cleaners and storage yards (fluorocarbons, other solvents), chemical and photographic labs (solvents, chemicals), lumber mills (creosote, PCPs, heavy metals), railroad yards (fuels, oils, solvents), and landfills (bacteria, methane, etc.).

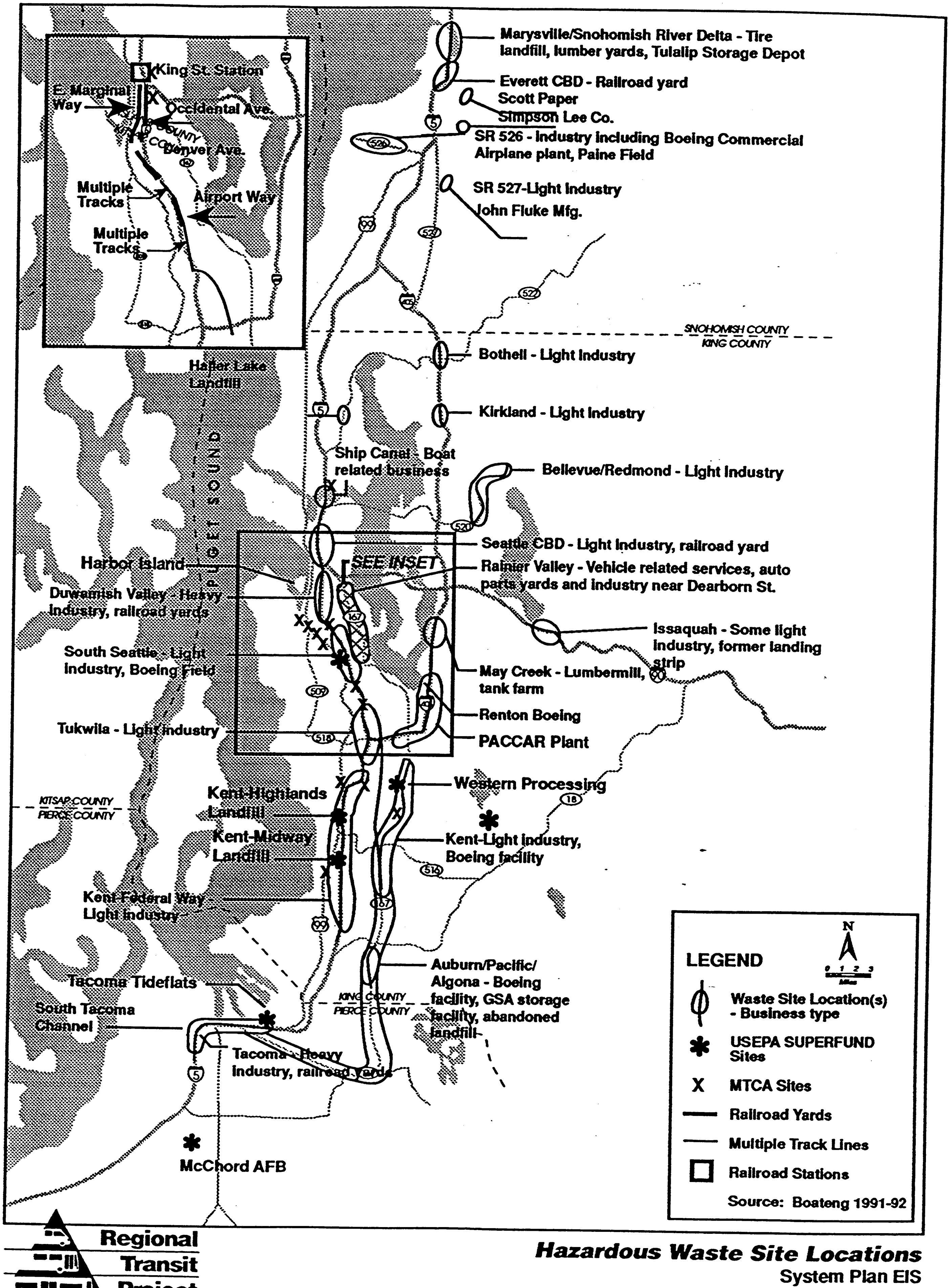
Distribution of Sites

Facilities using potentially hazardous materials are found along various segments of the project corridors (Figure 3.12 and Table 3.7.1). Heavy industry is generally found in the major industrial areas of Seattle, Tacoma, and Everett. Vehicle-related businesses and services are found along almost every corridor and as such are not shown on Figure 3.12. There are a number of sites identified by EPA as Superfund sites and by Ecology as potentially significant hazardous waste sites in the region near the rail and transitway corridors (Table 3.7.2)

Table 3.7.1. Generalized Hazardous Materials Users by Corridor.

North Corridor Area	Description of Users
Marysville/Snohomish R (I-5)	Tire landfill, lumber yards, other industries; military storage depot n. of Marysville
Everett	Vehicle-related and other businesses, rail yard, light industry
SR-99	Automotive services, dry cleaners, light industry
Broadway/Commercial (Everett)	Electric substations (potential PCB contamination)
SR-526, South Everett (I-5)	Gas stations, industry, Boeing aircraft, Paine Field
Lynnwood (I-5)	Vehicle-related, other businesses, some light industry, small metal foundry
Mntlk Terrace/Edmonds (I-5)	A few gas stations
Northgate/Green Lake (I-5)	Vehicle-related business, some light industry
Ship Canal (I-5)	Vehicle-related businesses, light industry/boat services
Capitol Hill (I-5)	Vehicle-related, other businesses, old Seattle City Light facility
Seattle CBD (I-5)	Vehicle, other businesses, light industry, rail yard
Lynnwood-Mukilteo (SR-525)	Vehicle-related businesses near I-405/I-5, I-405/SR-99
Everett to Mukilteo (SR-526)	Vehicle-related, other businesses near I-5/SR-99; Boeing plant, Paine Field
South Corridor Area	**Description of Users**
Duwamish Valley (I-5)	High concentration of haz waste users , generators; Boeing Field, related industries
Rainier Valley (I-5)	Vehicle-related, other business, light industry
Tukwila/Allentown (I-5)	Vehicle-related, other business, light industry; former coal mines, demolition landfill
Kent/Federal Way (I-5)	Auto-related business, light industry; Superfund, other landfills
Milton/Fife/Tacoma Tideflats	Heavy industry, Superfund area
Tacoma CBD (I-5)	Vehicle-related, other businesses; light industry; rail yard, station
S Tacoma Channel (I-5)	Superfund site; major industrial area, railroads, vehicle-related, other businesses
Lakewood	Vehicle-related businesses, McChord AFB (Superfund site)
Renton/Kent (SR-167/Green R)	Light industry, Superfund site, vehicle-related businesses, Kent Air Park
Auburn/Pacific/Algona (SR-167)	Various businesses, Boeing, GSA storage area, vehicle-related businesses
Puyallup R/I-5 (SR-167)	Industrial area at intersection
BN/UP ROW, yards	Railroads
Sumner industrial area	Battery , plastic, and yeast manufacturing, wood treatment,
East Corridor Area	**Description of Users**
S Snohomish/Bothell (I-405)	Vehicle-related business, office parks
Kirkland, NE 124th St (I-405)	Vehicle-related business, light industry
Bellevue CBD (I-405)	Vehicle-related business, some industry
Bellevue/Renton (I-405)	Tank farm, lumber mill at May Cr/Lake Washington
Renton CBD (I-405)	PACCAR plant (Superfund site), Boeing
Tukwila (I-405)	Vehicle-related business, light industry
Mercer Island (I-90)	Vehicle-related, other business
I-405 to Redmond (SR-520)	Businesses in Overlake, Redmond CBD, light industry

Source: Boateng & Associates; July 1991



Regional Transit Project

KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

RPTF0204F

Hazardous Waste Site Locations

System Plan EIS

Figure 3.12

Table 3.7.2. Identified Known or Potentially Significant Hazardous Waste Sites.

Area	EPA Superfund	Ecology MTCA
Snohomish County		Everett Tire Fire Everett Landfill
University District		BP Service Station
Seattle CBD		Union Station
Duwamish Valley	Harbor Island	Pioneer Porcelain Enamel Longview Fiber Reichold Chemical/Lone Star Cement Sternoff Metals Marine Vacuum Service Metro South Base Baker Commodities Coast Crane Jorgensen Steel
Renton	PACCAR Manufacturing	
Green River Valley	Western Processing	Northwest Slag Disposal
S. King County (I-5)	Midway Landfill Kent Highlands Landfill	U-Haul Northwest Powder Coats
Pierce County	Tideflats Industrial Area South Tacoma Channel McChord Air Force Base	

3.7.1.2 Electromagnetic Fields

The power lines and electrical equipment used by electrically powered transit vehicles produce electromagnetic fields (EMFs). Recent studies have identified biological effects and possible health risks associated with human exposure to EMFs. The following discusses EMFs as potential environmental hazards and examines the relevancy of these concerns to the technologies under consideration by the RTP.

Sources of EMFs

All electric currents produce magnetic fields. Naturally occurring magnetic fields are produced by solar radiation, ionizing radiation, currents within the earth's interior, and deep space radio emissions. Weak magnetic fields are also produced as part of the natural functioning of organisms.

Natural background magnetic fields have historically been weak. The electrification of society has resulted in the exposure of living things to a complex milieu of elevated EMFs across all frequency ranges. EMFs from power lines, wiring, and electrical devices are found in utility corridors, industrial plants, office buildings, public transportation systems, homes, and elsewhere. EMF strengths depend on local electric circuit geometry, current strength, and distance between sources and exposed individuals.

Characteristics of EMFs

Magnetic fields form continuous loops around electrical currents, diminishing in strength rapidly with distance from the source. Larger current flows produce stronger fields. Overlapping fields may either increase or reduce field strengths depending on their relative orientation. Field strengths tend to be highly variable from location to location and over time at the same location. Commonly experienced EMF strengths are generally reported in milligauss, abbreviated "mG."

Potential Health Effects of EMFs

Although electromagnetic fields appear to cause a variety of biological effects, the underlying mechanisms remain largely unknown and the health implications for humans have yet to be clearly determined (Anderson 1991). Concern about health risks has focused on EMFs associated with extremely low frequency alternating currents (AC) carried by electrical transmission lines and used in most wiring and appliances. Epidemiological studies have demonstrated a consistent association between increased risks for some cancers and EMF exposure. However, there are strong theoretical arguments against such effects and the possibility of confounding factors has not been adequately dealt with (Wilson 1992). Although some types of EMF exposures may pose health hazards, the evidence is generally recognized as too weak to allow firm conclusions. The U.S. Environmental Protection Agency has asserted that there is no evidence to show that EMFs cause cancer in humans and that more research is needed.

Because of the limited understanding of EMF health effects and how they could be caused (Bracken 1991), critical dose and exposure thresholds are not well defined. A number of studies suggest that the strength of an electromagnetic field is not necessarily the most significant or only parameter related to health effects. EMF effects at different field strengths vary in unusual ways. A field of one intensity may have an effect, while higher or lower intensities may not. There is a general scientific consensus that it is premature to prescribe regulatory limits for EMF exposures.

Unlike the fluctuating EMFs associated with alternating current, EMFs associated with direct current (DC) are static. Although very strong static EMFs (with strengths above 10,000 gauss) affect heart function, studies of commonly experienced static EMFs have not produced evidence of serious health hazards (Miller 1987).

Transit-Generated EMFs

EMFs from electrically powered transit systems have two principal sources: the power distribution system, and vehicle traction motors and associated control equipment. Metro's electric vehicles, including electric trolleys, dual mode buses, and waterfront streetcars, draw power from direct current distribution systems. Future electric transit vehicles would probably also use a DC distribution system.

Because the DC current used in most transit distribution systems is rectified AC current, it contains significant vestiges of AC current, which creates a time-varying EMF. However, the strength of the AC ripple is significantly less than the strength of common AC-induced EMFs and does not appear to be of particular concern. On the other hand, most electrical motors on

electric transit vehicles use AC current produced by on-board inverters and propulsion control systems. The intensity and direction of the EMFs produced by this equipment depend on equipment type, location, and filtering or shielding used to reduce interference with nearby communications or control systems.

There is little information available on the nature, levels, or significance of human EMF exposures from electric transit systems. However, the Volpe National Transportation Systems Center is researching health effects from advanced rail technologies, including maglev and high-speed rail, and existing mass transit systems. The study will address EMF control, mitigation, and regulatory options. The results of this study and parallel studies will be reported in forthcoming RTP environmental studies.

3.7.1.3 Air Pollution Effects on Health

Section 3.2.1 describes the air pollutants of concern in the region. There is increasing evidence that elevated air pollution levels contribute to diminished respiratory health, especially for individuals with respiratory disorders or otherwise impaired respiratory function. Relationships have been demonstrated between increased air pollutant levels and increased hospital admissions for asthma suffers, increased average annual risk of death, and increased mortality rates. The health effects of air pollution impose significant costs on society, including higher health care costs, insurance rates, and absenteeism.

Carbon monoxide (CO) is highly toxic. When inhaled, CO reduces blood oxygen-carrying capacity and blood flow, leading to reduced alertness, manual dexterity, learning ability, driving ability, and energy and contributing to increasing chest pains for angina patients. Pregnant women and people with heart disease, asthma, angina, or vascular disease are particularly affected by CO.

Nitrogen Dioxide (NO_2) is a toxic gas which plays a key role in producing ozone. Ozone (O_3) irritates eyes, damages lung tissues, reduces resistance to colds and pneumonia, aggravates heart disease, asthma, bronchitis and emphysema, and contributes to tiredness and diminished athletic performance.

Particulate Matter refers to total suspended particulates (TSP) and inhalable particles 10 microns or less in diameter (PM_{10}). Particulates often carry toxic elements which can damage the respiratory, digestive and lymphatic systems. PM_{10} in particular is associated with breathing problems, lung damage, and cancer. Individuals with influenza, chronic lung or heart disease or asthma, and the elderly, children, infants, and smokers are the most sensitive to PM_{10}.

Sulfur Dioxide (SO_2) has been associated with respiratory diseases and increased mortality rates.

3.7.2 Construction Impacts

Potential impacts to environmental health are similar for all build alternatives. Persons involved in excavating, trenching, or moving soil may be affected by hazardous materials. Persons living or working near such sites

may also be exposed through skin contact, ingestion, or inhalation of soil particles, dust, or vapors. If safe work practices are followed in site preparation and development, the risk of significant adverse impacts is low.

Portions of the alternatives cross or include railroad tracks, railroad yards, and other industrial and commercial sites. These rights-of-way and sites may be contaminated with fuels, oils, and materials that have leaked from railroad cars. The risk of explosion also exists in soils contaminated with combustible hazardous wastes, especially in the case of vapors associated with fuels. Contaminants would be likely to have entered the soil and groundwater because rail beds are typically built with good drainage.

Hazardous materials can travel in groundwater hundreds of feet beyond the boundaries of the properties from which they originated, contaminating soil on properties purchased for rights-of-way. Similarly, groundwater pumped out during tunneling may be contaminated and require special treatment or disposal.

3.7.2.1 No-Build Alternative

Construction for the No-Build Alternative involves mainly expansion of a few park-and-ride lots. Hazardous waste would probably have only a small effect on this alternative. Transit service improvements would likely not be affected by hazardous waste.

3.7.2.2 TSM Alternative

Construction of some TSM facilities may require excavation or grading of existing land surfaces. The improvements would likely not be affected by hazardous materials.

3.7.2.3 Transitway/TSM Alternative

Transitway facilities may require excavation or grading. Hazardous materials may be found, particularly along the railroad rights-of-way proposed for the South and East Corridor busways. The transit improvements would likely not be affected by hazardous materials.

3.7.2.4 Rail/TSM Alternative

The Rail/TSM Alternative has the greatest potential for encountering hazardous materials. Reasons for this include:

- Parts of the rail line would be constructed below grade.
- The commuter rail line will use existing tracks that pass near rail yards.
- The total extent of construction is far greater than for the other alternatives.

Where portions of the rail line are planned to be below grade (particularly close to previous or existing industrial sites on the Rainier Valley and Capitol

Hill alignments), the potential for encountering hazardous materials increases, since the amount of excavation will increase.

Commuter Rail Element

Railroad yards and working tracks are likely sites for hazardous materials spills. Businesses and industries along railroad rights-of-way are also likely to store hazardous materials. It is possible that previously unknown hazardous sites may be discovered at station locations. Project-level planning will include site audits if warranted.

3.7.3 Operations Impacts

Operation and maintenance of a transit system requires using substances that may affect human health if and when improperly handled or disposed of. Oil-based lubricants, vehicle batteries, parts cleaning fluids, paints, solvents, and fuels are among the products typically used in any transit maintenance facility. Transit vehicles, like other vehicles, are subject to fluid leaks.

The regional transit operators have worked to protect employee health and meet the regulatory requirements of the Clean Air Act, Clean Water Act, Toxic Substances Control Act, Resource Conservation and Recovery Act, and the Occupational Safety and Health Act. Health and safety training is mandatory for maintenance employees. Spill response and communication plans have been developed and implemented. Hazardous materials are disposed of following applicable regulations. Because the three build alternatives propose more transit vehicles and maintenance facilities, they are likely to use more hazardous substances and generate more waste than the No-Build Alternative. The Rail/TSM Alternative, because it uses more electric vehicles, would have lower risks from hazardous materials than the other two build alternatives.

Commuter Rail Element

Using conventional diesel technology, commuter rail may result in less emission of some air pollutants per passenger mile than SOVs and three-person carpools, but will slightly increase emissions of nitrogen oxide per passenger mile as compared to SOVs and emissions of other pollutants as compared to buses or electric rail. Significantly increased health risks are unlikely.

3.7.4 Mitigation of Impacts

3.7.4.1 Construction Impact Mitigation

Mitigation measures for contaminated properties located within the corridors include either the rerouting of the alignment or investigation and remediation of the properties and health and safety monitoring. Businesses that handle or generate hazardous materials (see Section 3.7.1.1) can be identified from street, topographic, land use, and zoning maps; aerial photos; telephone directories; and visual inspection. EPA and Ecology have lists of Superfund, hazardous waste, and underground storage tank sites. Properties to be purchased or used for rights-of-way will undergo a Level I environmental site audit (see below). In many cases, where hazardous materials have been known to be associated with a site, such investigations have already

been done and, for many, remediation has been performed and documented. Hazardous waste sites may also be "discovered" during construction.

Rerouting the Alignment may require buying additional property, which should be investigated for potential hazardous materials in the soil and groundwater. Expenses of rerouting include property costs, increased expenditures, and decreased speeds and operating efficiency if the route is lengthened.

Investigation and Remediation. The initial *Level I* process of investigation may include a records search, site history review, and/or site inspection. Local, state, and federal lists may be reviewed to determine if the site and nearby sites produce, store, generate, or have released hazardous materials. If further action is required, a *Level II* site audit would evaluate contamination migration pathways and receptors, including collecting and evaluating soil, water, or soil gas samples, air quality monitoring, literature searches, and documenting the findings. If these determinations are inconclusive, then a *Level III* site audit could summarize the procedures and results of the previous investigations and proceed to intense investigation, including developing and implementing a sampling and monitoring program for soils, groundwater, and surface water. If the site is contaminated and the alignment is not rerouted, then further remediation would be required, including either:

- Removal and proper disposal of soil, water, or both
- In-place treatment of soil and water.

Health and Safety Monitoring would be done on work sites with potential hazardous materials. Air can be monitored for concentrations of combustible organic compounds (e.g., gasoline vapors), explosive atmospheres, oxygen concentration, and carbon monoxide concentration. Water may be tested for the presence of hazardous materials. Proper clothing, breathing equipment, and other measures can be used to provide a safer working environment.

3.7.4.2 Operation Impact Mitigation

The transit operators will continue to meet health, safety, and hazardous waste regulations, segregate hazardous wastes, and protect employee health through ventilation, fire protection, and other measures. State-of-the-art oil/water separators and stormwater detention will minimize contaminated runoff. Whenever feasible and prudent, nontoxic substances will be used.

Air pollutant emissions of diesel-powered commuter rail could be mitigated by introduction of "clean diesel" and natural gas technologies.

Given the lack of evidence for and limited understanding of potential health risks from exposure to EMFs produced by electric transit vehicles or power distribution systems, "prudent avoidance" is an accepted strategy for avoiding adverse effects. Transit operators should avoid, prevent, or minimize situations where EMF exposures would be significantly different from commonly experienced exposures. The electric technologies under consideration have been used extensively in other systems and are consistent with a policy of prudent avoidance.

3.8 Visual Quality and Aesthetic Resources

3.8.1 Affected Environment

Existing visual resources can be described in terms of major natural and built features along the rapid transit corridors (Figure 3.13).

3.8.1.1 Natural Features

The region is well known for its natural scenic beauty. The local topography is diverse, with hills providing vistas of marine areas, lakes, rivers, forests, and mountains. The waterways are exceptional visual resources. Parks, cemeteries, and golf courses are examples of managed open space that provide a visual contrast to the urban environment. Steep hillside slopes, river corridors, and greenbelts are examples of other open space that provide visual relief, definition, and screening of views on hillsides and along rivers and roadways.

Land Forms

The region has many hills and valleys that allow for prominent views. The Cascade and Olympic Mountains are visible throughout the area. Especially valued are views of Mt. Rainier and Mt. Baker. Other significant land forms include ridges, plateaus, river valleys (e.g., the Green River Valley), islands, and wooded and environmentally sensitive areas.

Water Features

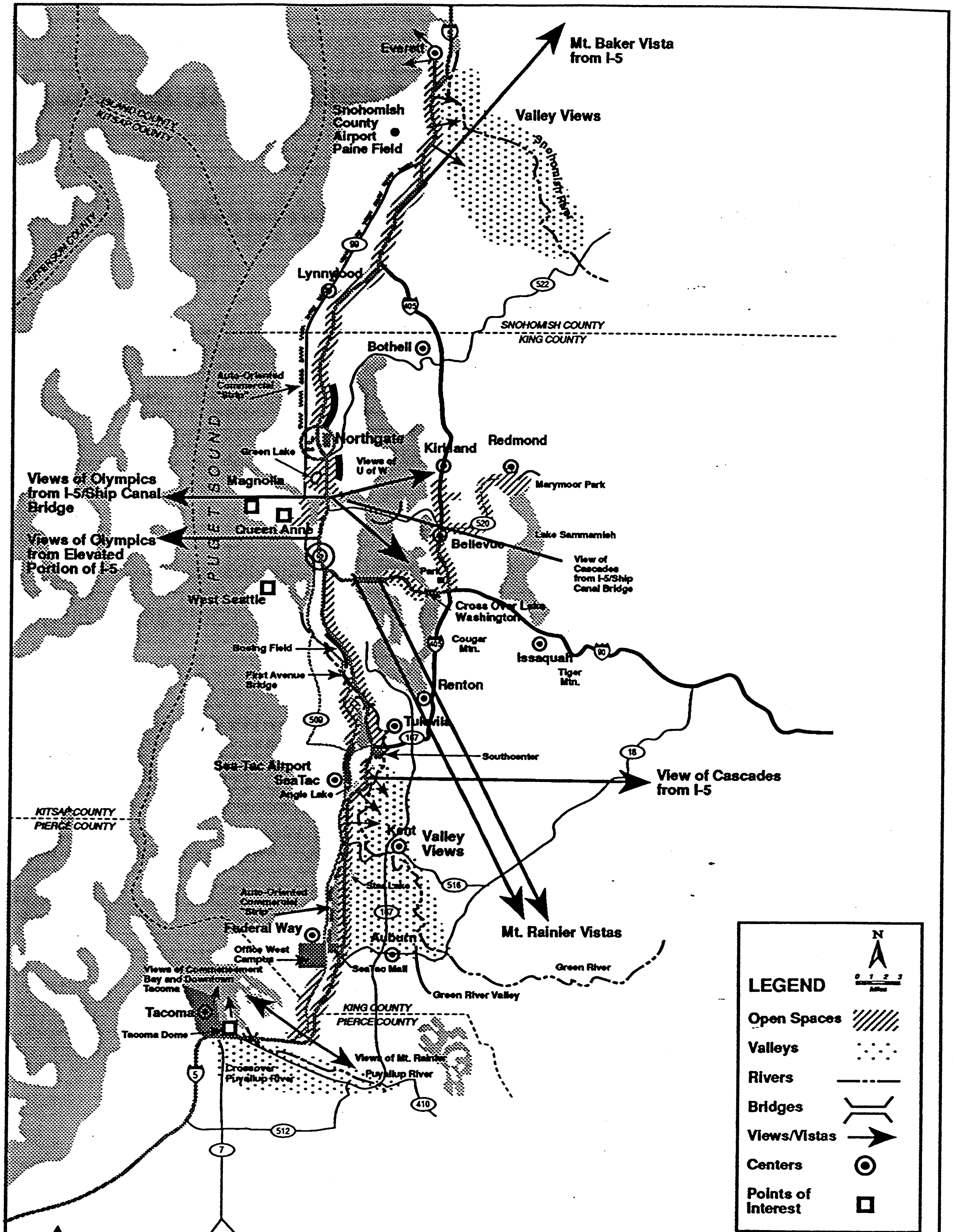
Views of Puget Sound, Bainbridge Island, the Kitsap Peninsula, and Vashon Island are enjoyed from the North and South Corridors. Lake Washington, visible from the East Corridor and Seattle, is also an important visual resource. Boating and fishing provide visual interest. Other lakes and rivers that are regionally significant due to their size or visibility include Lake Sammamish, Green Lake, Lake Union, Lake Stevens, the Lake Washington Ship Canal and the Puyallup, Duwamish, Green, White, Cedar, Sammamish, and Snohomish Rivers.

3.8.1.2 Built Features

Built landmarks assist in identification of areas and in orientation. The downtown Seattle, Tacoma, and Bellevue skylines are prominent landmarks. Other examples are the Kingdome, Space Needle, Tacoma Dome and the floating bridges. The north-south ridges, hills, and valleys of the region have also shaped the built environment, including distinctive hillside residential neighborhoods such as Capitol Hill, Queen Anne, and Hilltop.

Residential Environment

Urban, High Density (Multi-Family) Residential highrise and midrise buildings tend to be located in urban centers where land costs are high. The most prominent examples are in Seattle. Streets in these areas frequently are in a grid pattern. High-density residential units are commonly in mixed-use settings, including retail and office uses.



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Regional Visual and Aesthetic Resources

System Plan EIS

FIGURE 3.13

Low Rise, Medium to High Density (Multi-Family) Residential buildings, consisting of two to four-story structures, exhibit a wide variety of visual characteristics depending on location, topography, and age. They are frequently defined by and reinforce the urban street grid pattern. Urban neighborhoods with a grid pattern often have a high visual quality because of consistent but interesting architecture, strategic placement of significant trees, and/or long views down street corridors.

In suburban areas, lowrise buildings are set back from the street and take on more varied forms, depending on the natural attributes of the area, including trees, water, views, and topography. Streets in suburban communities sometimes curve to create special land features and vistas. Uncoordinated development can create a patchwork visual effect.

Transitional Areas have single-family housing mixed with other types of land use. Changes in scale between building types gives these areas a less homogeneous appearance than others. Lowrise commercial buildings, convenience malls, and apartments with parking lots may encroach on public rights-of-way, lending the community a bulkier scale. Such communities may even be visually dominated by large-scale industrial or commercial development.

Single-Family Residential communities, like lowrise residential communities, have a range of visual qualities depending upon location, density, and configuration of vehicular/pedestrian access. In urban, medium density communities, streets may follow a grid or a curvilinear pattern, but houses will be located close to one another. In the suburbs, homes tend to have more space around them and curved streets and cul-de-sacs are typical. Suburban densities may vary from low to almost rural. Often there are no sidewalks. The curvilinear road pattern and continuous landscaping create an appearance of a more open environment.

Nonresidential Environment

There are five basic types of nonresidential development. Each type's aesthetic character varies depending on location, topography, perceived identity, street pattern, and recent development.

Urban Office/Retail Areas have four distinct types. *Downtown Seattle* has a compact concentration of highrise and midrise buildings surrounded by lower scale, less compact development. In the core, buildings abut street property lines, while building setbacks and parking lots create more variety in the surrounding area. *Downtown Bellevue and Tacoma* also have strong visual identities. While they follow the traditional street grid, they have smaller cores and are less densely developed than Seattle. All three cities have similar aesthetic characteristics, including skyline views, landmarks, and the activity created by a mixture of uses.

Major Commercial Areas, such as Lynnwood, accommodate the automobile. Signage and parking are visible from wide, sometimes curved arterials. These areas lack strong identities, distinguishable architecture, or unique landmarks. Large size and practical function make them recognizable regional destinations. *Neighborhood and Smaller City Commercial Areas*, such as South Tacoma and downtown Everett, consist of lowrise buildings built up to the property line. Many structures are older in style and character and show signs of reuse. These areas tend to be pedestrian-oriented, fit within the existing street pattern, and relate to nearby residential scales. They often provide identity for the surrounding neighborhood.

Suburban Office/Retail Areas, such as Totem Lake, are distinct from their urban counterparts in that their aesthetic character is commonly determined by the natural features of the surrounding area (e.g., trees, vegetation, and topography). They often have a less formal, more relaxed form. Curvilinear street patterns and more landscaping or parking lots are significant visual characteristics. *Office Parks*, such as those in Canyon Park, tend to be developed with loosely arranged lowrise buildings surrounded by parking lots. As a result of incremental development, they often have a patchwork pattern.

Highway Oriented Commercial areas, such as SR-99 in the North Corridor, are similar to major commercial areas, but are strung out along an arterial street and frequently composed of smaller buildings or groups of buildings. These areas are often surrounded by residential areas with traditional grid patterns. However, such an area may cut across the grid because it follows a major topographic feature or historic road. Buildings are between one and three stories high and are interrupted by vacant lots or parking areas. Such an area is frequently not perceived as having a distinct beginning or end. *Suburban Retail Areas*, such as Tacoma Mall, are also auto-oriented but typically do not relate to the arterial street serving them and have no strong locational identity.

Town Centers, such as downtown Issaquah, have concentrated mixed uses. The traditional pattern consists of a main street with one or more intersections creating a central place with a strong identity. Buildings are low and commonly reach the property line.

Educational and Medical Campuses, such as the University of Washington, may have large or small buildings organized around pedestrians or vehicles. They contrast with neighborhood land use and access patterns and may or may not be buffered by landscaping.

Industrial/Manufacturing Areas include airports and air industry areas (e.g., Boeing), shipping/warehousing areas (e.g. Green River Valley in Kent), heavy industry, (e.g., Port of Everett, Duwamish Valley, Tacoma Tideflats), and light industry. The first two types have buildings which lack a human scale and provide few orienting elements. While heavy industry commonly relates to the grid street pattern, light industrial parks are often developed along curved streets lined with smaller buildings. The image of light industrial parks is determined by the natural features of the area.

Agricultural areas (e.g., Green, Puyallup, and Snohomish river valleys) have very low densities and are oriented to the rectangular township/range/section pattern with interruptions by topography, water, or vegetation.

3.8.1.3 Effects of Air Pollution on Visual Quality

Particulate matter and ozone (O_3), both related to transportation, contribute to diminished visual quality. Particulate matter soils buildings and reduces visibility. Ozone is the primary component of smog, which plagues the region during extended periods of clear weather. For more discussion on standards and regional levels of these pollutants, see Section 3.2.

3.8.2 Construction Impacts

3.8.2.1 No-Build Alternative

Only minor construction impacts would be caused by this alternative.

3.8.2.2 TSM Alternative

Dust and mud could result from construction. Temporary construction signage and heavy equipment would also be present on sites. Some sites would lose mature vegetation. HOV access ramps could require retaining walls or cut-and-fill on steep slopes, also resulting in vegetation loss. Managed open space could be manipulated to avoid visual impacts more easily than natural open space.

Park-and-ride lots in residential areas may cause a visual discontinuity in the form of paved open space next to houses. Structured parking garages could also conflict with the scale and character of surrounding areas. The visual impact of HOV lane construction should be minor except where streets and highways are widened or views are blocked. Widening of arterials or highways to accommodate HOV lanes, without mitigation, could increase the visual impact of the roadway and reduce visual buffers between roadways and adjacent uses.

3.8.2.3 Transitway/TSM Alternative

Visual impacts of the Transitway/TSM Alternative would be similar to those of the TSM Alternative. However, the transitway would require new ramps at many freeway access points, as well as an aerial structure between downtown Bellevue and SR-520, increasing visual impacts. New station area development would for the most part be unobtrusive. However, the scale of new buildings and parking lots could conflict with compact neighborhood commercial patterns. In fully developed urban locations, commercial buildings may be displaced by the alignment or stations.

3.8.2.4 Rail/TSM Alternative

In addition to TSM improvements, construction of the Rail/TSM Alternative would require temporary signage, the presence of heavy equipment, and dust and mud on construction sites. The extent of construction impacts would be greater than for the other alternatives, particularly at tunnel portal locations and underground station sites.

Urban stations may displace existing commercial and residential buildings. The long platforms may visually separate primary circulation routes. Station construction may also remove existing vegetation and open space. At-grade alignments may require removal of visual buffers along freeways. Parking areas could conflict with the scale of surrounding development and increase paved areas.

Visual impacts would differ between tunnels, retained cuts, at-grade, or aerial profiles. Tunnels would not interfere with existing views. Retained cuts would minimize the visual presence of overhead wires. At-grade rail would require barriers or fencing, which could interfere with views across the right-of-way and would be visible from nearby land uses. Urban rail lines, which could possibly be built near the ends of the lines in Pierce and

Snohomish counties, could visually enhance auto-oriented commercial corridors. Aerial alignments would be the most visible and could significantly affect views through view blockage, shading, and creating a visual barrier. There would be relatively few additional ramps blocking views adjacent to freeways (unlike the Transitway/TSM Alternative), since trains would not need to directly connect with HOV lanes.

Commuter Rail Element

No new rail alignments would be built, so visual impacts would be limited to station areas. Station-area planning would be used to maintain or enhance visual quality.

3.8.3 Operations Impacts

3.8.3.1 No-Build Alternative

This alternative would have minor direct local impacts on aesthetic resources. Increased traffic congestion could negatively affect aesthetics and increase air pollution, resulting in the loss or degradation of views.

3.8.3.2 TSM Alternative

Increased intensity of use at park-and-ride locations could affect the aesthetic qualities of adjacent areas. At bus transfer areas, the increased presence of buses could affect the pedestrian character and appearance of established urban streets. Additional illumination could change the visual character of areas around park-and-ride lots.

3.8.3.3 Transitway/TSM Alternative

New stations will affect the appearance and character of local areas. However, impacts on residential character should be minimal since stations will be on freeways, at existing park-and-ride lots, or in activity centers. Attractive transit centers with good pedestrian connections may enhance the visual quality of some activity centers.

The aesthetic character and identity of suburban town centers and auto-oriented commercial areas could be strengthened by new transit centers serving as focal points for shopping and offices. Stations could encourage higher residential densities around them, which would alter the suburban single-family aesthetic.

3.8.3.4 Rail/TSM Alternative

Rail stations, parking, signage, lighting, and related uses could intrude on established residential areas. Intrusion could be minimized by locating stations on arterials and designing aesthetically-compatible facilities. In town centers, large commercial areas, office parks, or mixed use areas, new transit centers could strengthen visual character by providing a focal point and encouraging infill development and pedestrian circulation. In older pedestrian-oriented commercial neighborhoods, at-grade rail stations could interfere with compact development patterns, depending on station size.

Commuter Rail Element

Impacts would be similar to those of the rapid rail system.

3.8.4 Mitigation of Impacts

Many construction impacts would be unavoidable and temporary. Vegetative screening could maintain the visual integrity of natural environments. Where feasible, vegetation removed during construction should be replaced.

Specific mitigation measures would be developed during project-level planning and the station area planning process for each station. Operational visual impacts can be mitigated through proper design of facilities, including landscaping, special signage, lighting, and compatible scale and building materials. Landscaping would replace lost vegetation and reduce the scale of parking facilities and stations. Night illumination should be directed downward to minimize spillover into residential areas or loss of light to the night sky.

Parking lots should be located and designed to be compatible with adjacent residential areas. While a grid pattern should be used next to grid street patterns, parking that follows topographic and building patterns will work better in more naturalistic residential areas. Terminal shelters could complement the architectural character of the surrounding area. Berms, trees, and shrubs could mask vehicle facilities. Stations could be designed for visual orientation. Design should emphasize quality as well as safety and separate vehicle areas and pedestrian activities.

Proper location and design of rail stations and alignments could minimize negative aesthetic effects and enhance urban and suburban character. Alignments should avoid or minimize impacts to viewpoints, parks, view corridors, and scenic routes. Stations and support facilities should fit into neighborhood service and retail areas adjacent to, rather than within, residential development. Height, scale, landscaping, built form, materials, paving, and street furniture should relate to preexisting architectural features. Landscaping and vegetative screening could reduce the visual impacts and enhance views. In areas with limited space or sensitive to new development, alignments and station elements could be located below grade.

3.9 Transportation

3.9.1 Affected Environment

3.9.1.1 Transportation Infrastructure

Roads and Highways

In 1988 there were approximately 15,000 miles of roads in the region. The interstate and state highway system, while representing only 7 percent of the road network, accounted for nearly half of VMT.

Railroads

Freight lines serve a number of towns in the region. Main lines operate from Tacoma to Seattle by way of the Green River Valley and from Seattle to Everett along Puget Sound. A main line also operates east across Stevens Pass from Everett. The Burlington Northern Seattle-Tacoma main line carries about 50 freight trains per day, plus six Amtrak passenger trains. The Union Pacific mainline carries about twelve trains per day. The BN line from Renton to Snohomish by way of Bellevue and Woodinville carries one two-way freight trip per day, as well as eight weekly round trips of a tourist train between Renton and Woodinville.

Transit Infrastructure

Storage and Maintenance. *Metro* has eleven facilities for storage and maintenance of its vehicles and for maintaining other capital facilities. *Community Transit* has one maintenance base and also contracts for service with Ryder Public Transportation Services, which has one maintenance base in Lynnwood and one south of downtown Seattle. *Everett Transit* and *Pierce Transit* each have one maintenance base.

Trolley Overhead and Electric Substations. Excluding the Downtown Seattle Tunnel, Metro has 55 miles of trolley overhead wires, receiving electrical power from 33 substations.

Downtown Seattle Tunnel and Associated Facilities. The Downtown Seattle Tunnel, an exclusive bus tunnel, is 1.3 miles long and includes five stations, staging areas at each end, and connections to the E-3 busway south of downtown. The tunnel has direct access to the I-5 express lanes at the north end and the I-90 center roadway at the south end.

Waterfront Streetcar Facilities and Stations. The Waterfront Streetcar system includes 2.1 miles of rail and overhead wire and nine stations connecting the International District, Pioneer Square, the ferry terminal, and Pier 70 on Elliott Bay.

Monorail. The City of Seattle's Monorail includes 2 miles of overhead track connecting Westlake Mall in downtown Seattle with Seattle Center.

HOV Lanes, where present, increase transit's speed and reliability. There are about 54 lane miles of HOV lanes on regional freeways. There are also 3 miles of arterial HOV lanes in Seattle and short segments of arterial HOV lanes in Bellevue. In addition, there are 17 HOV priority lanes on area freeway ramps, two HOV exits from the I-5 express lanes, and HOV lanes for preferential boarding of some ferries.

Park-and-Ride Lots and Transit Centers. At present, there are 85 lots served by public transit in King County with a total capacity of 14,994 cars. Snohomish County has 26 lots with 3,788 stalls. Pierce County has 18 lots with 2,010 stalls. Metro has 10 transit centers, Community Transit has six, and Pierce Transit has five. Some transit centers are in conjunction with park-and-ride lots. Others, like Aurora Village, Kirkland, and Tacoma Community College, are independent facilities allowing timed transfers between routes, as well as pedestrian connections to centers.

3.9.1.2 Traffic Volumes and Trends

Since 1960, daily vehicle miles traveled (VMT) have more than quadrupled, while freeway mileage has increased by 24 percent and total roadway mileage by 39 percent. By 2020, VMT is expected to more than double. In the same period, freeway lane miles will increase only slightly. Total roadway mileage will increase by 15 percent.

In the past 30 years, VMT has increased faster than population growth (Figure 3.14). More households have two workers, new housing and businesses have located in the suburbs, cities have become more dispersed, and the number of vehicles and length of trips per household has increased. As a result, congestion, travel time, and traffic accidents have also increased. "Normal" congestion caused about 30 million person-hours of delay in 1984; by 1990 this figure had risen by 50 percent. In 2005, "normal" congestion will cause about 75 million person-hours of delay. The average peak hour freeway speed is forecasted to decrease from 26 mph in 1990 to 14 mph by 2020.

Regional travel times will suffer from congestion and delays. Average peak hour travel time in 1991 was 30 to 35 minutes. In 2020, average travel time is expected to be 45 minutes to Northgate and Bellevue and 60 minutes to Sea-Tac Airport (Figure 3.15). Increasing travel time means regional destinations will be less accessible. It will also become more difficult and expensive to transport goods within the region. Both these factors have negative economic effects.

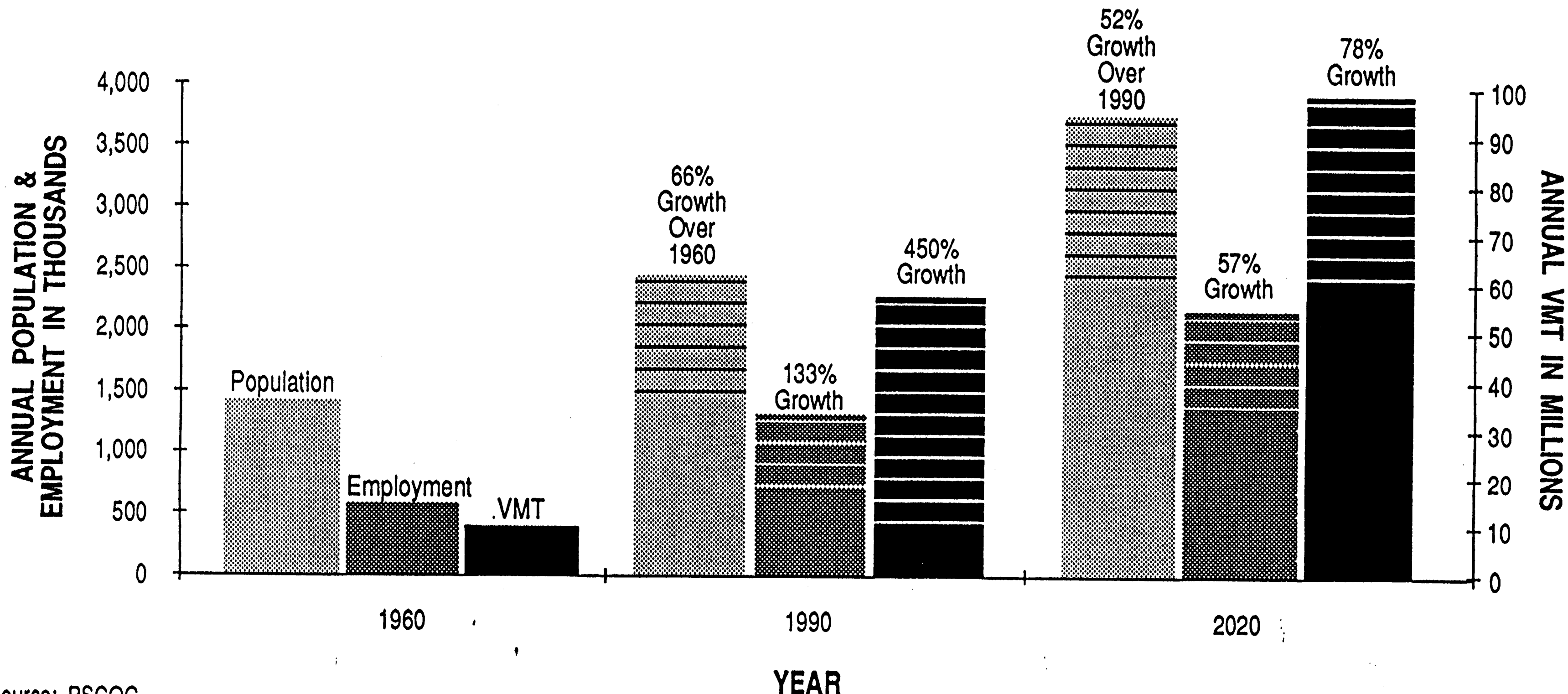
Because this EIS focuses on regional impacts, traffic volumes at specific locations have not been studied. However, as an example, Figure 3.16 shows traffic growth on a section of I-5 just south of SR-520. Between 1970 and 1987, the morning and evening peak periods blended into a single all day peak period. Not until the new I-90 bridge opened did the morning and evening peaks return. It is likely that the peak period will again spread to the middle period of the day.

Although public transit could provide an alternative to increased congestion, that congestion and the increasing dispersion of home and work sites have kept transit ridership from realizing its potential. Transit ridership per capita increased significantly during the 1970s, due to two oil supply crises and major public investment in transit operations (Table 3.9.1). From 1982 to 1992 it has remained constant at about 33 annual rides per capita.

Table 3.9.1. Changes in Transit Ridership per Capita.

Date	Annual Transit Ridership per Capita	% Change
1960	34	-
1970	22	-36%
1980	36	+64%
1990	33	-9%

1960 TO 2020
TRAVEL, POPULATION, & EMPLOYMENT GROWTH
FOR KING, PIERCE & SNOHOMISH COUNTIES



Source: PSCOG
Population & Employment Forecasts, June 1988

Regional Transit Project
KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY
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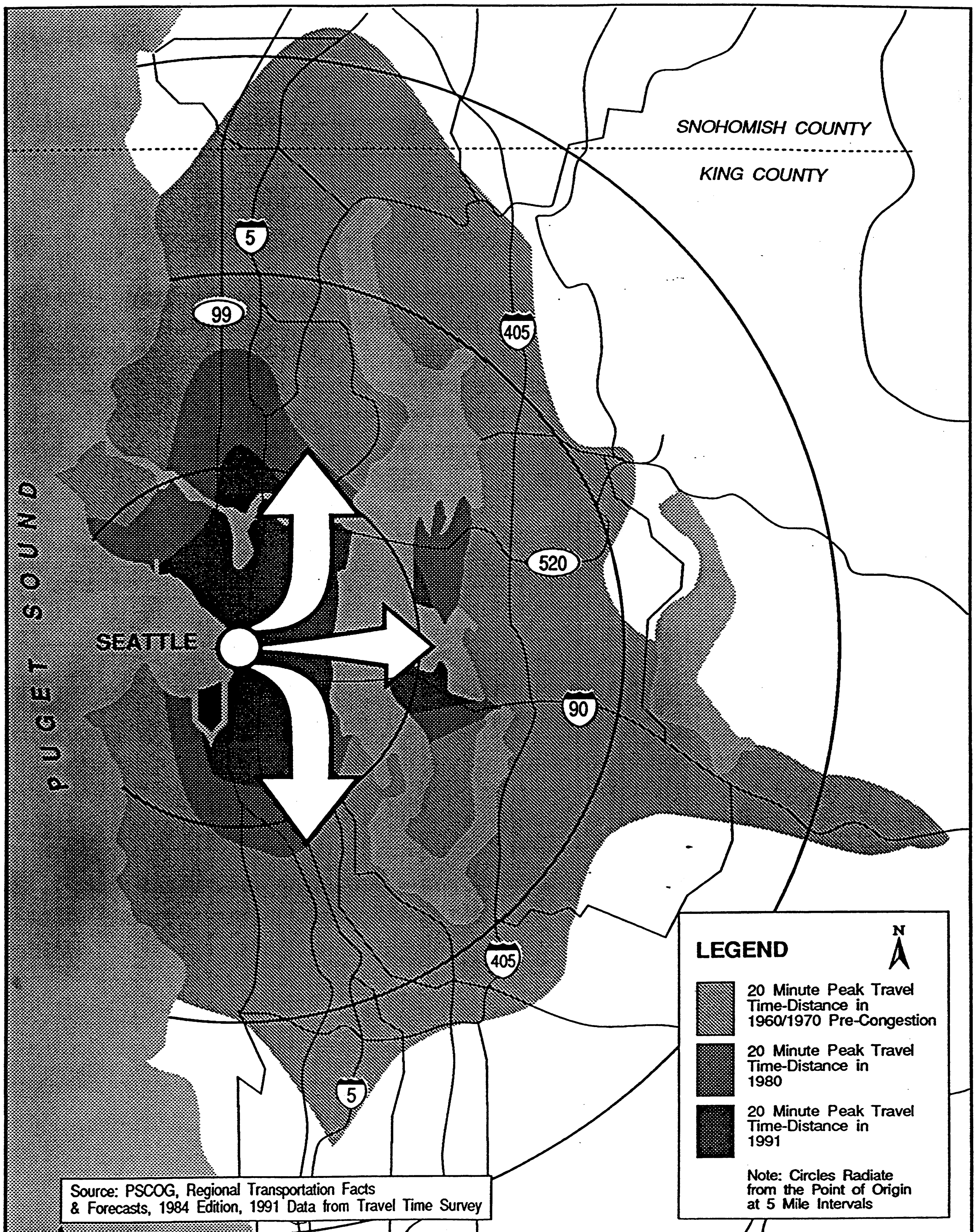
Travel, Population, & Employment Growth
System Plan EIS
FIGURE 3.14



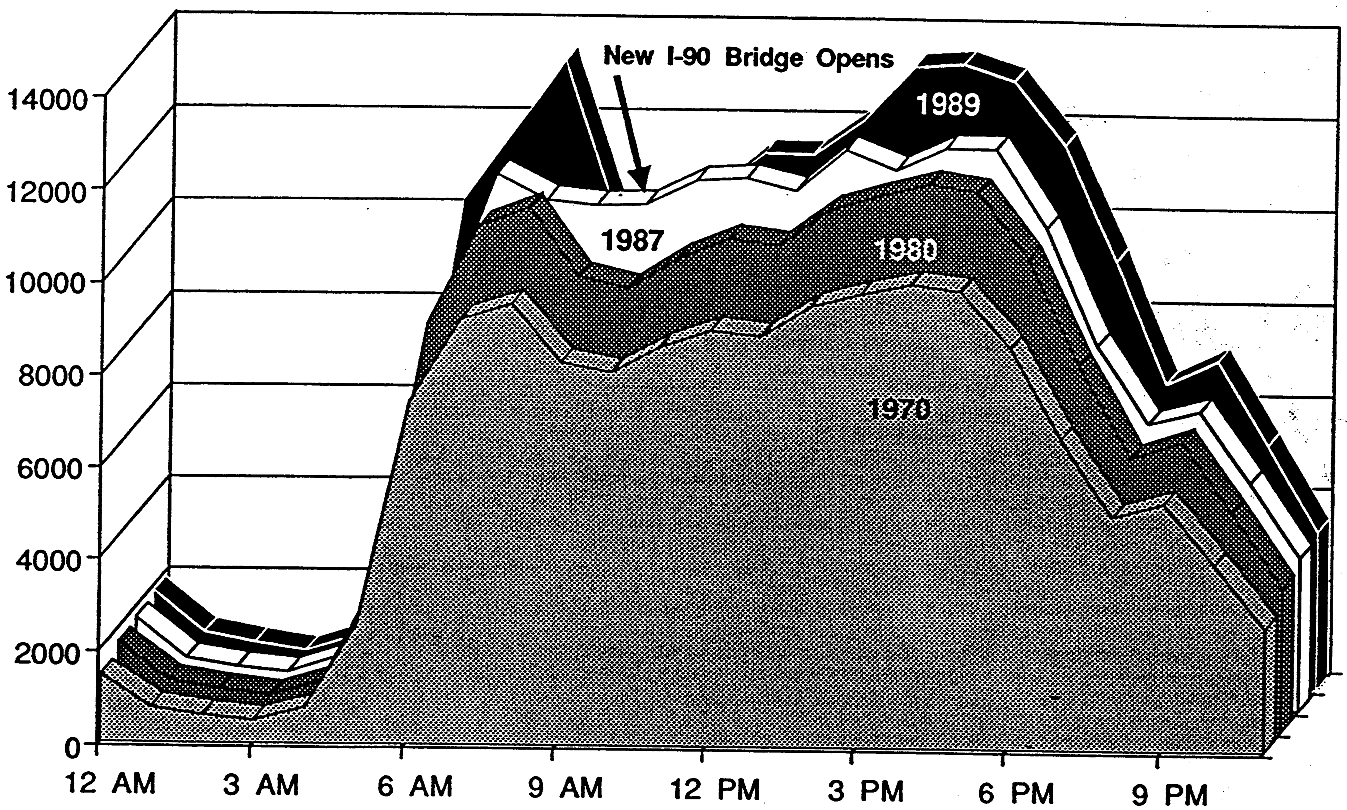
Regional Transit Project

Automobile Travel Time Contours from Downtown Seattle

System Plan EIS

FIGURE 3.15

HOURLY TRAFFIC DISTRIBUTION ON I-5 (South of SR-520) AND THE SPREAD OF PEAK-PERIOD CONGESTION



Source: Washington State Department of Transportation

3.9.1.3 Transit Operations and Ridership

For evaluation, transit routes were defined for each alternative, including all King County routes and regionally significant Pierce and Snohomish county routes. In 1990, weekday ridership was 284,000. Thirty-nine percent of the trips were in the North Corridor, 26 percent in the South Corridor, 6 percent in the East Corridor, and 29 percent in downtown Seattle.

Community Transit

Community Transit had 4 million riders in 1990. CT operates two types of express service, as well as custom subscription service. *Commuter* service operates to downtown Seattle, Bellevue, and Redmond Monday through Friday in the peak period and the peak direction, with five to 35 minute headways. Limited off-peak service is provided to downtown Seattle. *University* service operates to the University of Washington all day Monday through Friday. Typical headways range from 15 to 35 minutes during peak periods. Community Transit also provides all day local service Monday through Saturday with 30 to 60 minute headways. All day *suburban* service operates between local communities in Snohomish County, as well as to Aurora Village and Bothell in King County. *Rural* service operates from northern and eastern Snohomish County to major centers.

Everett Transit

Everett Transit provides fixed-route service within Everett and to points just outside the city limits. There were 1.5 million riders in 1990. Service on Monday through Friday is from 5 a.m. to 10 p.m., with 30 to 60 minute headways. Everett Transit offers more limited service on Saturdays and Sundays.

Municipality of Metropolitan Seattle

Metro operates service within King County, with ridership of 77.2 million in 1990. *Local* bus service operates daily on a fixed-route, fixed schedule basis with typical peak headways of 10 to 60 minutes and midday headways of 15 to 60 minutes. *Express* service consists of commuter-oriented peak limited-stop service with typical headways of 20 to 60 minutes. *Custom* service is express bus service for groups of 40 or more commuters not served by regular transit service. *Paratransit* service using vans or smaller vehicles is operated on fixed routes or flexibly with advance reservations in areas that cannot support regular bus service. The *Waterfront Streetcar* links downtown Seattle's waterfront and Pioneer Square with 20 to 30 minute headways.

Pierce Transit

Pierce Transit operates within Pierce County and to King and Thurston counties. There were 10.4 million riders in 1990. *Express* routes serve downtown Seattle every 15 to 30 minutes in the peak period. *Local* routes operate every day on arterials in Pierce County and to Federal Way and Enumclaw in King County. Peak headways range from 15 to 60 minutes. Off-peak headways range from 15 minutes to 2 hours.

Typical Regional Transit Travel Times

Transit travel times depend on traffic volume and speed, since most buses operate in mixed traffic. Transit travel has slowed as the region's highways

have become more congested. In 1990, average transit travel times to selected centers ranged from 35 to 84 minutes (Table 3.9.2). Average 1990 travel times to downtown Seattle, Bellevue, and Everett and to the University District were 43, 51, 65, and 48 minutes, respectively. These travel times represent the average of all trips taken on transit to the selected centers, including time spent traveling to and from the bus.

Table 3.9.2. PM Peak Period Weighted Average Door-to-Door Transit Travel Time from Selected Centers to Destinations within the Region (in minutes).

		1990 Existing	No-Build		TSM		Transitway		Rail	
	Selected Destination	Travel Time	Travel Time	Change from Existing	Travel Time	Change from No-Build	Travel Time	Change from No-Build	Travel Time	Change from No-Build
1	Everett	65	63	-2	60	-3	52	-11	47	-16
2	Paine Field	78	83	5	74	-9	63	-20	51	-32
3	Lynnwood	58	57	-1	53	-4	49	-8	40	-17
4	Northgate	46	52	6	46	-6	43	-9	36	-16
5	University District	48	51	3	47	-4	49	-2	37	-14
6	Seattle CBD	43	45	2	43	-2	41	-4	38	-7
7	Bothell	67	71	4	64	-7	61	-10	57	-14
8	Bellevue	51	57	6	51	-6	49	-8	43	-14
9	Overlake	84	88	4	80	-8	79	-9	60	-28
10	Redmond	65	71	6	63	-8	63	-8	51	-20
11	Renton	63	68	5	62	-6	61	-7	51	-17
12	Tukwila	64	73	9	66	-7	66	-7	55	-18
13	SeaTac	69	75	6	64	-11	60	-15	48	-27
14	Kent	78	83	5	64	-19	60	-23	54	-29
15	Auburn	74	80	6	64	-16	63	-17	58	-22
16	Federal Way	66	71	5	62	-9	60	-11	52	-19
17	Tacoma	35	35	0	34	-1	33	-2	32	-3
Regional Average		48	50	2	46	-4	45	-5	40	-10

Existing Modal Splits

"Modal split" here means the percent of trips that occur by transit as compared to automobiles. Between one and 38 percent of work trips in the region take place on public transit, depending on the location of the work site. Downtown Seattle and the University District have the highest transit shares with 38 and 23 percent, respectively. Bellevue, Renton, Northgate, Tukwila, SeaTac, and Tacoma have transit shares between three and six percent. Other major centers have transit shares between one and three percent.

3.9.1.4 Other Transit Modes

Private Bus Service

Intercity Bus Services in the three-county area include Greyhound, Evergreen Trailways, Cascade Trailways, and Trailways Northwest. Major stations are located in downtown Everett, Seattle, and Tacoma and are well served by

public transit in those areas. *Airporters and shared-ride vans* provide mostly demand-responsive express service to Sea-Tac International Airport. Fixed-route service is available from downtown Seattle.

Rail Lines and Monorail

Amtrak provides one daily train each way from Seattle and Everett to Spokane and runs three trains a day each way in the Seattle-Tacoma-Portland corridor. Stations at Everett, Seattle, and Tacoma are well served by public transit. The City of Seattle Monorail links downtown Seattle and Seattle Center every 15 minutes during the day and evenings. Rail transit has no significant role in moving people within the three-county region.

Ferries

Washington State Ferries provides vehicle and passenger service from Seattle and Tacoma to Vashon Island, from Mukilteo to Whidbey Island, from Edmonds and Vashon Island to Kitsap County, and from downtown Seattle to Bainbridge Island and Bremerton. Ferry loading docks include HOV lanes to give priority to buses and carpools at peak commuter periods. There is also passenger-only service from downtown Seattle to Vashon Island and Bremerton. Pierce County Ferry links Steilacoom to Ketron Island and Anderson Island. The Victoria Clipper provides a passenger link between Seattle and Victoria, B.C.

Community Transit serves Edmonds and Mukilteo ferries at least hourly except Sunday. There is frequent Metro service to downtown Seattle ferries. On weekdays, Metro serves the Fauntleroy terminal at least every half hour, the Vashon terminal every 60 to 90 minutes, and the Vashon-Tahlequah terminal with eight trips, while Pierce Transit serves the Tacoma-Vashon and Steilacoom terminals at least every 30 minutes.

Air Service

Most regional, national, and international air service is provided at Sea-Tac International Airport. Service to the San Juan Islands and British Columbia is also provided from Lake Union in Seattle and Lake Washington at Kenmore. Metro serves Sea-Tac Airport and Kenmore at least every half hour and serves Lake Union every 15 to 30 minutes.

3.9.1.5 Bicycle Connections to Transit

An extensive designated bicycle route system is envisioned for the region. Most bicycle routes follow existing streets, rather than using exclusive rights-of-way. Major exclusive bikeways include the Burke-Gilman Trail from Seattle to Kenmore, the Sammamish River trail from Bothell to Redmond, the I-90 trail from Seattle to Bellevue, and the Interurban Trail in the Green River Valley. Most bicycle routes intersect transit routes. Bicycle lock-up facilities are also provided at many park-and-rides. In addition, Pierce Transit can transport bicycles on most buses. Metro transports up to two bicycles per bus on a few routes connecting Seattle with the eastside and is currently planning to equip all its coaches with bicycle racks to allow expanded transporting of bicycles.

In spite of the extent of the bicycle circulation system, many regional and local trips are difficult to make by bicycle. In some areas, freeways form barriers to bicycle access from one side to the other. Major arterials often lack bicycle lanes and, although formally available to bicycles, present safety hazards for bicyclists. In some areas, freeways and major arterials are the only direct routes between neighborhoods, which effectively denies access by bicycle.

3.9.1.6 Pedestrian Connections to Transit

Because much of the region has developed in response to the automobile and lacks pedestrian amenities, many areas could be considered "pedestrian-unfriendly." Pedestrian amenities that encourage use of transit include sidewalks; parking strips or trees buffering arterials from walkways; crosswalks at intersections; and laying out commercial areas to allow pedestrians to reach buildings without crossing large parking lots. Many parts of the region lack these amenities. In these areas, it is more difficult for pedestrians to reach bus routes or transfer between routes, even when the bus service is available.

3.9.2 Impacts of Construction

3.9.2.1 No-Build Alternative

This alternative would involve no major new construction by transit agencies. Construction of new facilities would have minor traffic impacts on surrounding roadways. Currently funded expansions of the regional road and highway network that have significance to transit are also assumed for the No-Build Alternative (see Section 2.1 and Technical Appendix A).

3.9.2.2 TSM Alternative

Construction of HOV improvements would have temporary adverse impacts on highway traffic. Traffic on arterials and neighborhood collectors could also be adversely affected by park-and-ride and transit base construction. While construction would eventually affect many freeways, highways, and arterials in the region, the construction period would be spread out over several years and would only have relatively short-term local impacts.

3.9.2.3 Transitway/TSM Alternative

This alternative would significantly affect traffic by closing the I-5 reversible lanes to SOVs (see Section 3.9.3.3). Building the South Corridor busway would require some relocation of railroad tracks and interruption of freight service along that alignment. Building the busway from downtown Bellevue to SR-520 could have temporary impacts on rail operations in that area. Other local construction impacts would be similar to, but slightly more widespread, than those described for the TSM Alternative.

3.9.2.4 Rail/TSM Alternative

Total construction impacts could be several times greater than for the TSM Alternative. If construction takes place in all three corridors at the same time, there might be negative effects on regional traffic congestion and speeds. In particular, work on or adjacent to the freeway system in several different locations could have cumulative effects that would lower speeds and increase congestion on other parts of the system. In addition to freeway congestion, construction could increase congestion on regional arterials as some trips were diverted from the freeways to these roadways.

Building tunnels would cause substantial truck traffic to dispose of earth. In addition, construction could require lengthy arterial lane closures if cut-and-cover construction is used. In areas where tunnels are constructed by boring, major disruption would be limited to portal and station areas, but could be considerable. Impacts would be even greater where cut-and-cover methods were used.

Because rail tracks have already been laid in the downtown Seattle bus tunnel, converting to rail operations could be accomplished without major disruptions of bus service through the tunnel. Most of the work would involve building high platforms for access to rail cars and could be done during hours when the tunnel is already closed. Temporary closure of the tunnel might be required at certain times during operating hours, resulting in rerouting of transit service to surface streets, but these disruptions would not be at peak hours or for significant periods of time.

Building at-grade alignments could have temporary adverse impacts at station locations and permanent impacts on traffic where the alignment replaced one or more traffic lanes. Building at-grade alignments could also temporarily or permanently block access from intersecting streets. Aerial structures could have temporary traffic impacts during construction and permanent impacts where they blocked lanes or turning movements.

North Corridor

Construction of at-grade alignments could permanently reduce the traffic capacity of SR-99 in Snohomish County, depending on the alignment chosen.

<u>Capitol Hill Alignment</u>. The baseline alignment from downtown Seattle to Everett, including the branch to Paine Field, would include 10 miles of tunnels, 12 miles at-grade, and 12 miles of aerial structures. The Convention Place Station would have to be reconstructed and expanded. Arterials in First Hill, Capitol Hill, the University District, and the Roosevelt neighborhood would be affected by tunnel portal and station construction.

<u>I-5 Alignment</u>. The alignment would include 7 miles of tunnels, 13 miles at-grade, and 12 miles of aerial structures. Approximately 2 miles of tunnels would be required for a people-mover between the I-5 station and the center of the University District. Construction of the rail line on two lanes of the I-5 express lanes would immediately reduce its traffic capacity and cause major congestion.

South Corridor

Aerial alignments could affect arterials in SeaTac and Federal Way, including removal of center turn lanes on SR-99. In Tacoma, the capacity of South "C" and Commerce Streets could also be reduced. The rail system would require building bridges across two navigable waterways, the Duwamish River and the Puyallup River. Although bridges would be designed to avoid adverse impacts on waterway traffic, there might be temporary disruptions to navigation during construction.

The rail system in the South Corridor using the baseline alignment along Rainier Avenue and Martin Luther King, Jr. Way would be at grade for 18 miles, aerial for 20 miles, and in tunnels for 5 miles. The Rainier Valley alignment staying on Rainier Avenue would replace an aerial mile with a tunnel mile. The Duwamish Valley alignment would include 22 miles at-grade, 17 miles aerial, and 5 miles of tunnels.

<u>Commuter Rail Element</u>. Commuter rail service linking Seattle and Tacoma could require upgrading existing tracks, construction of passing tracks and switches, and increased signalization, as well as construction of stations and park-and-ride lots. This could cause brief disruption of freight and passenger (Amtrak) rail operations. Construction of commuter rail stations and park-and-ride lots may also result in adverse effects on local traffic circulation.

East Corridor

The rail system in the East Corridor would include 28 miles at-grade, 17 miles of aerial structures, and 4 miles of tunnels. Downtown Bellevue would be affected by tunnel portal and station construction. Arterials in Bellevue's Overlake area would be affected by construction of an aerial alignment. If the South Bellevue Way alignment was chosen, tunnel construction would have significant traffic impacts on South Bellevue Way, including temporary closure of some traffic lanes and temporary loss of access to the South Bellevue park-and-ride. Lane closures would increase congestion along South Bellevue Way as well as I-405, the most likely alternate route.

Some segments of the new rail lines would use existing rail rights-of-way. Construction of the system along the BN right-of-way between Bellevue and Renton would require relocation of existing track and reconstruction of switches for crossings. Disruption of freight operations could be significant. Disruption or blockage of cross streets could also take place.

3.9.3 Impacts of Operation

Ridership and Traffic Assumptions

Ridership under the four alternatives was estimated for 2020, based on expected patterns of land use and trip demand. Ridership figures include only trips on the "regional system," which does not include some local bus service in Pierce and Snohomish counties. Ridership figures also do not include ridership on demand-responsive service, vanpools, or carpools, except where those trips continue onto the regional system. Levels of these types of service were expected to be similar across all the build alternatives.

Regional traffic levels were estimated based on PSRC's forecasted traffic network, with adjustments made based on the number of trips that had been diverted to the transit system (as indicated by ridership forecasts). It was assumed that there would be no regionally significant changes in traffic speeds due to any of the alternatives.

Ridership Capacity Constraints

Forecasted transit ridership would increase significantly between 1990 and 2020 because of population and employment growth, increased congestion, and higher parking costs, as well as because of improved transit service under the three build alternatives. Except for the Rail/TSM Alternative, projected ridership would be higher in downtown Seattle than the transit system could handle. Under the No-Build Alternative, bus service levels would not be increased to meet projected demand. As a result, overcrowding on buses would be particularly severe in downtown Seattle during the peak period. Projected ridership was reduced when the forecasts indicated unrealistically high passenger loads. Under the TSM, Transitway/TSM, and Rail/TSM Alternatives, planned bus service levels were increased to meet expected demand. However, the street capacity of downtown Seattle for buses during the peak periods (about 450 surface and 200 tunnel buses per hour in the peak direction) would be exceeded under both the TSM and Transitway/TSM Alternatives. Ridership forecasts for the TSM and Transitway/TSM Alternatives were adjusted downwards to reflect these constraints. Under the Rail/TSM Alternative, enough surface buses would be replaced by underground rail that there would be no capacity constraints in downtown Seattle.

Higher Densities, Transportation Demand Management, and Ridership

Ridership for the four alternatives was estimated conservatively, assuming no change in adopted land use plans or measures to discourage automobile use. Because of this, ridership estimates should be considered the minimum ridership that can be expected. Changes in land use plans to encourage higher densities or measures to discourage automobile use would result in additional ridership on the system.

To test the effect of increasing densities or discouraging automobile use on system ridership, ridership was estimated for two additional scenarios: (1) implementation of the Vision 2020 preferred alternative; and (2) implementation of the Commute Trip Reduction Act. The results, as detailed below, showed increased ridership for each of the build alternatives, with the Rail/TSM Alternative showing the greatest gains.

Increases in ridership would be also likely if additional Transportation Demand Management programs are instituted for employers and other traffic generators not covered by the Commute Trip Reduction Act. In addition, increases in ridership are likely due to the growth management policies adopted by King County, which in some cases call for densities greater than those proposed by the Vision 2020 preferred alternative. Finally, the transit corridors program proposed by the RTP for the build alternatives should increase ridership beyond that projected by increasing densities along selected transit routes and in centers and by encouraging transportation demand management measures and pedestrian-oriented site design.

Impact of Vision 2020 on Ridership and Vehicle Trips for Each Alternative

PSRC's Vision 2020 preferred alternative includes policies supportive of public transit, including land use changes and higher parking charges in centers. Implementation of Vision 2020 would increase transit system ridership by 12 percent in the case of the Rail/TSM Alternative, 7 percent under the TSM and Transitway/TSM Alternatives, and 3 percent under the No-Build Alternative. Correspondingly, implementation of Vision 2020 would reduce daily automobile trips by about 14,000 under the No-Build Alternative, 40,000 under the TSM and Transitway/TSM Alternatives, and 81,000 under the Rail/TSM Alternative. The lower impact on TSM and Transitway/ TSM ridership is due to the transit capacity constraints in downtown Seattle (Travel Forecasting Results Report, PBQD 1992). The lower impact on No-Build ridership is due to limited numbers of buses serving increasing demand.

The transit share of work trips to major centers would increase under Vision 2020 from 16 to 19 percent under the Rail/TSM Alternative, with the most significant changes occurring for downtown Seattle and Bellevue. The transit share would increase from 13 to 14 percent under the TSM and Transitway/TSM Alternatives.

Impact of Trip Reduction Legislation

The Commute Trip Reduction Law requires major employers and employers at major employment sites to reduce SOV commute trips. This law could reduce peak VMT by 5 percent, which would increase Rail/TSM Alternative ridership by 13 percent (73,700 daily trips) (PBQD 1992). Increases under the Transitway/TSM and TSM alternatives would be about 8 percent because of transit capacity constraints in downtown Seattle. Because of a limited bus fleet, the No-Build Alternative would only attract about 4 percent more riders. The law could switch 34,800 SOVs per day to HOVs by 2020.

Implementation of Vision 2020 and Commute Trip Reduction legislation together would have a greater effect than implementation of either one alone. Assuming Vision 2020 by itself would account for only 50 percent of intended work trip reductions, by 2020 the two together would increase Rail/TSM ridership by 18 percent, TSM and Transitway/TSM ridership by 11 percent, and No-Build ridership by 5 percent.

Accessibility for the Elderly and Disabled

All of the alternatives include significant increases in services for the elderly and disabled. A portion of these increases are mandated by the Americans with Disabilities Act (ADA). The increases will include substantially expanded door-to-door service and increased accessibility of transit vehicles (see discussion in Section 2.1.1). In addition, the build alternatives will include similar levels of substantially increased demand-responsive door-to-door service for all patrons in certain areas. Expansion of the transit fleets under all build alternatives will incorporate measures to facilitate access to transit vehicles by the elderly and disabled, further increasing the accessibility of the system. Expansion of the system itself will also increase regional accessibility for these sectors of the population.

3.9.3.1 No-Build Alternative

Traffic Volumes and Parking

Regional. Vehicle trips are expected to grow considerably between 1990 and 2020 (Table 3.9.3). In the North Corridor, for instance, daily vehicle trips will increase 63 percent from 2.3 million in 1990 to 3.7 million in 2020. A 64 percent increase in daily vehicle trips is expected in the South Corridor and a 93 percent increase in the East Corridor.

Table 3.9.3. 1990 and 2020 (PSRC Adopted) Performance Measure Characteristics for Daily Vehicle Trips for All Purposes (in thousands).

Auto Vehicle Trips

Corridor	1990	2020 No-Build	2020 TSM	Percent Reduction from No-Build	2020 Transitway	Percent Reduction from No-Build	2020 Rail	Percent Reduction from No-Build
North Corridor	2,277	3,702	3,620	-2.2%	3,610	-2.5%	3,496	-5.6%
South Corridor	3,328	5,471	5,386	-1.6%	5,381	-1.6%	5,300	-3.1%
East Corridor	1,059	2,037	2,004	-1.6%	2,001	-1.8%	1,942	-4.7%
Three-Corridor Total*	6,664	11,210	11,010	-1.8%	10,992	-1.9%	10,738	-4.2%
Three-County Total	6,735	11,298	11,098	-1.8%	11,080	-1.9%	10,874	-3.8%

Vehicle-Miles of Travel

Corridor	1990	2020 No-Build	2020 TSM	Percent Reduction from No-Build	2020 Transitway	Percent Reduction from No-Build	2020 Rail	Percent Reduction from No-Build
North Corridor	19,700	32,834	32,101	-2.2%	32,012	-2.5%	31,002	-5.6%
South Corridor	17,730	29,466	29,006	-1.6%	29,981	-1.6%	28,544	-3.1%
East Corridor	7,880	15,154	14,909	-1.6%	14,888	-1.8%	14,450	-4.6%
Three-Corridor Total*	45,310	77,454	76,016	-1.9%	75,881	-2.0%	73,996	-4.5%
Three-County Total	47,185	84,189	82,695	-1.8%	82,562	-1.9%	81,030	-3.8%

Vehicle-Hours of Travel

Corridor	1990	2020 No-Build	2020 TSM	Percent Reduction from No-Build	2020 Transitway	Percent Reduction from No-Build	2020 Rail	Percent Reduction from No-Build
North Corridor	797	2,208	2,159	-2.2%	2,153	-2.5%	2,085	-5.6%
South Corridor	700	1,572	1,547	-1.6%	1,546	-1.7%	1,522	-3.2%
East Corridor	307	975	959	-1.6%	957	-1.8%	929	-4.7%
Three-Corridor Total*	1,804	4,755	4,665	-1.9%	4,656	-2.1%	4,536	-4.6%
Three-County Total	1.877	5,109	5,018	-1.8%	5,010	-1.9%	4,917	-3.8%

*Excludes Kitsap County

Vehicle miles traveled (VMT) will increase substantially from 1990 to 2020. VMT will increase by 67 percent between 1990 and 2020 in the North Corridor, 66 percent in the South Corridor, and 92 percent in the East Corridor. As the number and length of daily automobile trips increase, traffic congestion will increase and average speeds will decrease, since the capacity of the transportation system will not increase significantly under this alternative. Vehicle hours of travel (VHT) will thus grow faster than VMT. In the North Corridor, VHT will increase by 177 percent between 1990 and 2020. In the South Corridor, VHT will increase by 124 percent and in the East Corridor by 218 percent.

Screenline Traffic Volumes. Traffic crossing eight screenline locations would increase significantly (Figure 3.17). For instance, between 1990 and 2020, traffic crossing the Ship Canal would increase 24 percent, from 540,900 to 668,200 vehicles per day, with no increases in highway capacity. Traffic crossing Lake Washington would increase by 38 percent, from 230,800 to 318,900 trips per day.

Parking. The No-Build Alternative would not have any direct effects on parking. Indirectly, parking demand is likely to increase as trips increase, reducing supply and increasing prices in some centers.

Transit Operations and Ridership

The transit fleet and infrastructure would remain essentially the same. Routes and schedules would not change. However, worsening congestion would reduce schedule reliability.

System Transit Ridership and Transfers. Total transit trips would increase by 37 percent to 388,500 trips per day in 2020 (Table 3.9.4). Most of the increase (70 percent) would be caused by regional household and employment growth. The remainder would be caused by increases in highway travel times and parking costs. Ridership would not keep pace with population growth. Ridership per capita would actually decline by about 14% (Table 3.9.5).

Table 3.9.4. Existing and 2020 (PSRC Adopted) Total Daily and Annual Transit Ridership and Transfers.

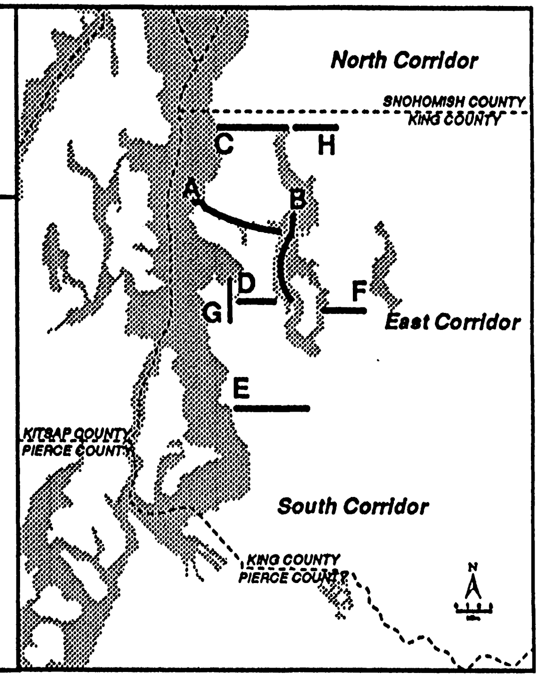
Alternatives	Estimated Linked Transit Trips	Estimated Transit Boardings	Transfer Rates	Annualized Linked Transit Trips (in millions)*
1990 (Existing)	284,200	365,400	1.29	80.3
2020 No-Build	388,500	497,400	1.28	109.4
2020 TSM	473,900	666,700	1.41	133.7
2020 Transitway	480,000	693,200	1.44	135.4
2020 Rail	560,500	838,500	1.50	157.3

*Excludes non-forecasted categories of ridership (i.e., school, custom bus).

Daily Volumes

Screenline	1990 Existing Vehicle Trips	No Build Vehicle Trips	TSM Vehicle Trips	TSM % Change From No Build	Transitway Vehicle Trips	Transitway % Change From No Build	Rail Vehicle Trips	Rail % Change From No Build
A Ship Canal	540,900	668,200	659,700	-1.3%	660,500	-1.2%	635,600	-4.9%
B Lake Washington	230,800	318,900	311,000	-2.5%	309,900	-2.8%	300,300	-5.8%
C N. 185th Street	279,700	374,600	371,300	-0.9%	372,100	-0.7%	361,500	-3.5%
D S. Spokane Strteet	299,700	356,600	349,900	-1.9%	347,400	-2.6%	347,100	-2.7%
E S. 188th Street	366,400	505,400	500,400	-1.0%	498,300	-1.4%	491,200	-2.8%
F I-405/Newport	120,200	170,800	169,300	-0.9%	169,600	-0.7%	167,000	-2.2%
G West Seattle Bridges	120,900	128,900	127,800	-0.9%	127,800	-0.9%	125,500	-2.6%
H Snohomish County Line on Eastside	331,400	482,200	481,200	-0.2%	481,100	-0.2%	477,600	-1.0%

Selected Screenlines



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2020 (PSRC Adopted) Daily Vehicle Volumes at Selected Screenlines
System Plan EIS
FIGURE 3.17

Table 3.9.5. Trips per Capita, 2020.

Alternative	Annual Trips (millions)	Trips per Capita	% Change from 1990
No-Build	109.4	29.0	-14%
TSM	133.7	35.4	7%
Transitway/TSM	135.4	35.9	9%
Rail/TSM	157.3	41.7	26%

Linked trips represent door-to-door travel that may include transfers. The ratio of total boardings to linked trips is the transfer rate. Under the No-Build Alternative, this rate will fall slightly to 1.28 (Table 3.9.4). The difference is due to decreasing transit reliability caused by congestion. Because transfers are dependent on timely connections, decreased reliability increases the uncertainty of transferring.

Transit Ridership By Corridor. Corridor transit ridership illustrates regional travel patterns (Table 3.9.6). The North Corridor generates 110,500 daily transit trips, rising by 27 percent to 140,300 trips in 2020 under the No-Build Alternative. Transit ridership in the East Corridor, South Corridor, and downtown Seattle is expected to increase 84 percent, 34 percent, and 42 percent, respectively.

Under the No-Build Alternative, the East Corridor share of transit trips would still be only 8.6 percent, compared to 36 percent for the North Corridor, 25 percent for the South Corridor, and 30 percent for downtown Seattle. The North Corridor share would decline slightly between 1990 and 2020 because the North Corridor will not grow as fast as the East and South corridors. Downtown Seattle will keep its share due to continuing development and its importance as an employment center.

Transit Ridership by Mode of Access. Under the 2020 No-Build Alternative, 77 percent of all riders will walk to the bus and 23 percent will drive (Table 3.9.7). This compares to 85 percent walking and 15 percent driving in 1990. The increase in drive access over walk access reflects a greater dependence on park-and-ride lots and a decreasing ability of fixed bus routes to serve outlying areas. As the urban area spreads, it becomes faster for suburban residents to drive to a park-and-ride lot than to catch a local bus.

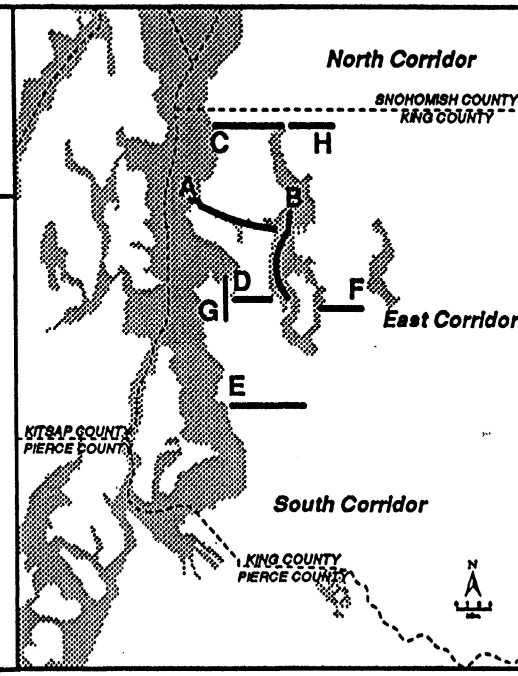
Transit Volumes at Selected Screenlines. Under the 2020 No-Build Alternative, daily transit trips across the Ship Canal would increase by 40 percent over 1990 (Figure 3.18). Transit volumes crossing Lake Washington, South 188th Street, and the West Seattle Bridge would increase between 58 and 67 percent. Transit volumes on I-405 at Newport Way and near Bothell would double.

Accessibility. Increasing traffic congestion and the lack of investment in park-and-ride lots or HOV lanes would reduce the accessibility of the system, particularly in the suburbs. Reduced reliability of schedules and longer trip times caused by increased congestion would reduce transit service quality, which would particularly affect transit-dependent populations. The quality of service to community facilities would also be adversely affected.

Daily Volumes

Screenline	1990 Existing Person Trips	No Build Person Trips	TSM Person Trips	TSM % Change From No Build	Transitway Person Trips	Transitway % Change From No Build	Rail Person Trips	Rail % Change From No Build
A Ship Canal	73,500	103,100	113,700	+10.3%	112,700	+9.3%	142,600	+38.3%
B Lake Washington	21,800	36,500	46,400	+27.1%	47,700	+30.7%	58,900	+61.4%
C N. 185th Street	12,400	25,600	29,700	+16.0%	28,700	+12.1%	41,400	+61.7%
D S. Spokane Strteet	41,800	56,500	65,000	+15.0%	68,000	+20.4%	83,500	+47.8%
E S. 188th Street	16,200	25,600	31,900	+24.6%	34,500	+34.8%	42,800	+67.2%
F I-405/Newport	1,900	5,300	7,200	+35.8%	6,900	+30.2%	10,000	+88.7%
G West Seattle Bridges	10,400	17,100	18,500	+8.2%	18,500	+8.2%	21,200	+24.0%
H Snohomish County Line on Eastside	300	600	1,800	+200.0%	2,000	+233.3%	6,100	+916.7%

Selected Screenlines



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2020 (PSRC Adopted) Daily Transit Volumes at Selected Screenlines
System Plan EIS
FIGURE 3.18

Table 3.9.6. Total Daily Transit Trips for Seattle CBD and Each Corridor by Origin and Destination.

1990

Origin District	Destination District 1	2	3	4	Total	Share
1 North Corridor	61,795	4,524	12,839	31,315	110,473	38.9%
2 East Corridor	4,524	5,330	1,570	6,702	18,126	6.4%
3 South Corridor	12,839	1,570	43,245	16,187	73,841	26.0%
4 Seattle CBD	31,315	6,702	16,187	27,467	81,671	28.7%
Total	110,473	18,126	73,841	81,671	284,111	100.0%

2020 No-Build Alternative

Origin District	Destination District 1	2	3	4	Total	Share
1 North Corridor	76,640	7,719	14,391	41,543	140,293	36.1%
2 East Corridor	7,719	11,303	2,625	11,720	33,367	8.6%
3 South Corridor	14,391	2,625	58,786	22,978	98,780	25.4%
4 Seattle CBD	41,543	11,720	22,978	41,543	116,058	29.9%
Total	140,293	33,367	98,780	116,058	388,498	100.0%

2020 TSM Alternative

Origin District	Destination District 1	2	3	4	Total	Share
1 North Corridor	105,533	10,669	18,555	42,151	176,908	37.3%
2 East Corridor	10,669	15,922	4,153	13,560	44,304	9.3%
3 South Corridor	18,555	4,153	86,638	24,539	133,885	28.3%
4 Seattle CBD	42,151	13,560	24,539	38,554	118,804	25.1%
Total	176,908	44,304	133,885	118,804	473,901	100.0%

2020 Transitway/TSM Alternative

Origin District	Destination District 1	2	3	4	Total	Share
1 North Corridor	107,542	10,606	18,467	42,482	179,097	37.3%
2 East Corridor	10,606	15,963	4,400	14,036	45,005	9.4%
3 South Corridor	18,467	4,400	87,999	24,945	135,811	28.3%
4 Seattle CBD	42,482	14,036	24,945	38,607	120,070	25.0%
Total	179,097	45,005	135,811	120,070	479,983	100.0%

2020 Rail/TSM Alternative

Origin District	Destination District 1	2	3	4	Total	Share
1 North Corridor	116,566	12,321	23,034	53,260	205,181	36.6%
2 East Corridor	12,321	16,785	5,839	18,645	53,590	9.6%
3 South Corridor	23,034	5,839	93,116	32,194	154,183	27.5%
4 Seattle CBD	53,260	18,645	32,194	43,418	14,517	26.3%
Total	205,181	53,590	154,183	147,517	560,471	100.0%

Accessibility of employment centers by transit from low-income areas would decline under this alternative. Transit travel times to employment centers in Everett, Bothell, Redmond, Auburn, and Tacoma from low income areas in Seattle, Everett, and Tacoma would increase by about 5 percent (BRW 1992).

Table 3.9.7. 1990 and 2020 (PSRC Adopted) Daily Transit Trips by Mode of Access.

Mode of	1990 Estimated		No-Build		TSM		Transitway/TSM		Rail/TSM	
Access	Trips	Percent	Trips	Percent	Trips	Percent	Trips	Percent	Trips	Percent
Walk	241,800	85%	299,300	77%	366,300	77%	369,900	77%	416,600	74%
Drive	42,300	15%	89,200	23%	107,600	23%	110,100	23%	143,800	26%
Total	284,100	100%	388,500	100%	473,900	100%	480,000	100%	560,500	100%

In general, transit travel times under the No-Build Alternative would increase between 2 and 9 minutes relative to 1990 (see Table 3.9.2). Access times to Everett and to Lynnwood would decrease slightly, due to improved transit service from Snohomish County to downtown Seattle and the University District.

Modal Splits. Under the No-Build Alternative, 34.5 percent of the trips to work in downtown Seattle would be by bus (Table 3.9.8), a decline from 1990. The transit share of trips to work in the University District would decrease slightly, to 22.3 percent. About 1 to 7 percent of trips would be by transit in the rest of the region, a slight increase when compared to 1990. However, the share of trips to work by transit would decline for Lynnwood and SeaTac.

Table 3.9.8. 1990 and 2020 (PSRC Adopted) Daily Transit Share for Work Trips to/from Selected Centers.

	Center	1990 Existing		No-Build		TSM		Transitway		Rail	
		Trips	Share	Trips	Share	Trips	Share	Trips	Share	Trips	Share
1	Everett CBD	2,760	2.0%	3,856	2.5%	7,018	4.6%	7,118	4.7%	7,700	5.0%
2	Paine Field	1,960	2.4%	2,000	1.8%	4,857	4.4%	4,951	4.5%	5,240	4.8%
3	Lynnwood	763	1.5%	1,150	1.3%	2,121	2.4%	2,268	2.6%	2,607	3.0%
4	Northgate	735	5.9%	1,095	7.4%	1,327	9.0%	1,325	9.0%	1,605	10.9%
5	University District	12,044	23.1%	14,050	22.3%	18,711	29.6%	17,948	28.4%	21,549	34.1%
6	Seattle CBD	77,861	37.7%	104,293	34.5%	105,959	35.0%	107,772	35.6%	141,183	46.6%
7	Bothell	67	2.5%	381	3.7%	544	5.3%	555	5.4%	592	5.7%
8	Bellevue CBD	1,177	3.9%	4,018	5.9%	5,171	7.6%	5,238	7.7%	5,732	8.4%
9	Overlake	191	1.7%	233	1.7%	444	3.2%	467	3.3%	654	4.7%
10	Redmond	85	1.2%	289	1.6%	398	2.2%	404	2.2%	505	2.8%
11	Renton	935	3.9%	1,363	4.8%	1,801	6.3%	1,800	6.3%	2,084	7.3%
12	Tukwila	689	4.3%	1,157	5.1%	1,513	6.6%	1,512	6.6%	1,804	7.9%
13	SeaTac	914	3.9%	831	2.5%	1,207	3.6%	1,311	3.9%	1,757	5.2%
14	Kent	111	1.2%	186	1.3%	384	2.8%	403	2.9%	419	3.0%
15	Auburn	105	1.1%	208	1.5%	348	2.5%	355	2.6%	374	2.7%
16	Federal Way	561	1.1%	1,259	1.6%	1,680	2.1%	1,710	2.2%	2,289	2.9%
17	Tacoma CBD	5,463	3.0%	7,242	3.1%	11,272	4.8%	11,352	4.8%	11,749	5.0%
	All 17 Centers	106,421	11.8%	143,612	11.3%	164,754	13.0%	166,486	13.1%	207,842	16.4%

Other Mass Transit Modes

Private bus services would be adversely affected by increased traffic congestion and the lack of a comprehensive HOV system. Trips could be expected to take longer and schedule reliability would worsen. Increased congestion would also reduce accessibility to ferry, rail, and air service.

Bicycle and Pedestrian Circulation

Bicycle and pedestrian connections to transit would remain the same. However, increasing automobile traffic volumes would reduce the ease of access to many transit facilities. Similarly, to the extent that continued auto dependence encourages urban sprawl and low density development, bicycle and pedestrian shares of travel would probably decline.

Relationship to Commute Trip Reduction

This alternative would not support efforts to reduce commuter trips to major employment centers, since there would be no change in transit service and no increase in HOV efficiency.

3.9.3.2 TSM Alternative

Traffic Volumes and Parking

Regional. The TSM Alternative would reduce auto vehicle trips, VMT, and VHT by between 1.7 and 3 percent relative to the No-Build Alternative (see Table 3.9.3). This level of reduction would probably not significantly reduce regional traffic congestion. The greatest traffic benefit would be felt in peak hour trips to and from the University District, which would be 5 percent less than under the No-Build Alternative. In addition, completion of the HOV lane system and addition of HOV lanes and other amenities to arterials would improve traffic movements for carpools and vanpools. This effect would be enhanced by existing and planned access management programs on area freeways.

Screenline Traffic Volumes. The TSM Alternative reduces daily vehicle trips by 0.2 to 2.5 percent from the No-Build Alternative, depending on location (see Figure 3.17).

Localized Impacts. Modeling has shown that reduction of traffic levels under the TSM Alternative, even by a few percent, could cause significant improvements in the levels of service at some congested intersections. The extent of the improvement or the number of intersections that would benefit cannot be determined at the system level of analysis.

Operation of park-and-rides could have significant impacts on local traffic on adjacent arterials and collector streets. Since park-and-ride lots are typically on arterials at or near freeway interchanges, lots might increase congestion on arterials that serve as freeway collector routes.

Attempts to limit parking supply in centers and in transit corridors could result in spillover effects on adjoining residential streets. Similarly, increased transit service to suburban park-and-ride lots could result in parking spillover onto residential streets if park-and-rides were not sized large enough to handle demand.

Transit Operations and Ridership

Transit speed and reliability would be greatly enhanced by completing the freeway HOV system, adding HOV improvements to arterials, improving transit connections, and expanding park-and-ride capacity. Direct bus routes would still link key centers with downtown Seattle.

Transit Operations. *Community Transit* would increase service frequency to downtown Seattle and the University District, expand service to Bellevue, Redmond, and Northgate, create new routes to major centers, and provide suburban and rural access to transit hubs. *Everett Transit* would offer more frequent service to neighborhoods, centers, and transit transfer points and increase peak period service to workplaces. *Metro* would develop a system of all-day regional and community routes providing frequent service to centers, neighborhoods, and transfer points. Metro would also expand customized services. It would use demand-responsive services to increase coverage in lower density areas. *Pierce Transit* would increase bus frequency, operate expanded and consistent two-way service along major routes, connect major centers with express peak hour service, and increase transfer frequency and convenience. For statistics on platform miles and hours for each transit operator, see Table 2.1.

Accessibility. Transit accessibility would be improved by increasing service frequency and providing better transit connections. Paratransit routes would expand into currently unserved areas. Increases in numbers and sizes of park-and-ride lots would improve accessibility of express routes. The increases in transit speed and reliability would improve accessibility from low-income neighborhoods to regional employment and commercial centers.

Travel time by bus to and from centers would decrease under the TSM Alternative relative to the No-Build Alternative (see Table 3.9.2). This is mostly due to increases in service frequency. Several centers, notably Kent and Auburn, would experience greater travel time savings due to other service improvements, including new routes.

Accessibility of employment centers by transit from low-income areas would also increase slightly under this alternative, both relative to 1990 and to the No-Build Alternative. Transit travel times to employment centers outside Seattle from low income areas in Seattle, Everett, and Tacoma would decrease by about 4 percent from 1990 and be about 7 percent lower than for the No-Build Alternative. However, reaching many of these centers from low-income areas would still require very long transit trips.

Total System Transit Ridership and Transfers. The TSM Alternative would have 473,900 daily riders, for a total of 133.7 million annual riders in 2020. Ridership under the TSM Alternative would be 67 percent higher than today and 22 percent higher than under the No-Build Alternative (see Table 3.9.4). Fifty-nine percent of the ridership growth is due to regional growth in households and employment. Another 25 percent is due to increased transit service and 16 percent to improvements in transit travel times. As shown in Table 3.9.5, ridership would increase only slightly more than population growth.

The transfer rate of 1.41 under the TSM Alternative is higher than either the 1990 and the No-Build Alternative transfer rate, due to improved service frequency allowing better transfer connections. A greater number of transit routes would meet at significant trip destinations such as downtown Seattle, transit centers, and park-and-ride lots. Restructuring of routes is a secondary reason for the transfer rate increase.

Transit Ridership By Corridor. Daily transit trips to and from the North Corridor would increase by 26 percent, or 36,000 (see Table 3.9.6). Ridership to and from downtown Seattle, the East Corridor, and the South Corridor would increase by 2,000, 11,000 and 35,000 daily trips, respectively, representing a 2.4, 33, and 36 percent increase relative to the No-Build Alternative. Although the North Corridor shows the largest gain in trips, the South Corridor displays the highest percent increase. The large increases in transit trips in the North and South corridors to and from downtown Seattle reflect the strong transit markets in those areas and the increases in transit service quality under this alternative.

Transit Ridership By Mode of Access. The mode of access to transit (walk versus drive) would not change significantly under the TSM Alternative.

Transit Volumes at Selected Screenlines. Increases in transit trips range from an 8.2 percent increase at the West Seattle Bridge to a 200 percent increase on I-405 near Bothell (see Figure 3.18). Most of the increases range between 10 and 35 percent.

Mode Split. The University District and downtown Seattle show the highest modal splits for work-related transit trips, with 29.6 and 35.0 percent of trips taking place by transit, respectively (see Table 3.9.8). When compared to the No-Build Alternative, transit work trips would increase to the selected centers by an average of one to two percent.

Other Mass Transit Modes

Rail and Intercity Bus. Increased express service to downtown Everett, Seattle, and Tacoma would improve regional accessibility of intercity service. Improved regional transit travel times might reduce private bus and airporter ridership between destinations in the region.

Ferries. The TSM Alternative would provide more frequent service to the ferry system, particularly to and from downtown Seattle. In addition, peak-hour service would nearly double to the Mukilteo, Edmonds, and Steilacoom ferry terminals. Peak-hour service to the Fauntleroy ferry terminal would also increase. Service to ferry terminals from Vashon Island would be enhanced with dial-a-ride service. Service increases would increase the number of walk-on passengers to the ferry system and reduce the number of vehicles, as compared to the No-Build Alternative.

Air Service. Although direct transit service to Sea-Tac International Airport would not increase, the TSM Alternative would increase transit speed, reliability, and connections to the airport. The alternative would also increase transit service to airlines at Lake Union and Kenmore.

Bicycle and Pedestrian Circulation

The TSM Alternative includes several measures to improve transit/bicycle connections. These include:

- o carrying bicycles on feeder and regional bus routes, consistent with operating safety, service quality, and passenger comfort
- o providing weather-protected bicycle storage at park-and-ride lots
- including improvements for safe bicycle travel on arterials as part of improvements for HOVs.

These measures would greatly enhance the connections between bicycles and transit.

Under the TSM Alternative, the regional transit agencies would work with local jurisdictions and landowners to encourage pedestrian amenities and pedestrian-oriented development along major arterials and at major intersections served by transit. Pedestrian access improvements near park-and-ride lots would also be considered during project-level design. Improvements in pedestrian access would both increase transit ridership beyond the estimate made during ridership modeling and would encourage reduced use of SOVs.

The increased transit service proposed under the TSM Alternative would have a moderate effect in terms of supporting more intensive use of land in some centers. To the extent this occurs, pedestrian and bicycle use would be likely to increase, since these modes become more efficient as land use intensifies.

Relationship to Commute Trip Reduction

Service increases under this alternative would provide some support to commute trip reduction efforts, particularly outside downtown Seattle. Completion of the HOV system and provision of arterial HOV improvements would also provide incentives for increasing vanpooling and carpooling.

3.9.3.3 Transitway/TSM Alternative

Exclusive transitways in the metropolitan core would allow buses to avoid traffic delays, increasing the speed and reliability of regional service. At the same time, I-5 between downtown Seattle and Northgate would become very congested due to reduced SOV capacity.

Traffic Volumes and Parking

The Transitway/TSM Alternative reduces traffic levels slightly more than the TSM Alternative. At the corridor level, it reduces vehicle trips, VMT, and VHT by between 2.1 and 3 percent over the No-Build Alternative (see Table 3.9.3). At the screenline level, the Transitway/TSM Alternative reduces traffic between 0.2 percent and 2.8 percent (see Figure 3.17).

In the South and East corridors, completion of the HOV system and providing HOV lanes and other improvements on arterials would slightly increase roadway capacity and improve circulation for carpools and vanpools. In the

North Corridor, the Transitway/TSM Alternative would reduce roadway capacity for general purpose traffic. Although total transportation capacity is increased, vehicle capacity is reduced because the Transitway/TSM Alternative removes the I-5 reversible lanes from general traffic use, with significant impacts on traffic congestion. In addition, considerable amounts of traffic would be diverted to other north-south arterials, including SR-99, 15th Avenue Northeast, and smaller neighborhood arterials. The result would be a general increase in traffic congestion in this area (PBQD 1991d). The degree of impact would probably constitute a fatal flaw for the transitway in the North Corridor.

The new busway would affect general traffic operations on I-90 between downtown Seattle and Bellevue. HOV traffic and general-purpose Mercer Island traffic would be displaced from the center roadway. Replacing the center roadway with outside HOV lanes, although feasible, would require a significant departure from federal interstate standards for lane and shoulder widths. The potential for accidents would be somewhat higher and incidents such as accidents and breakdowns would have a greater effect on traffic congestion.

The Transitway/TSM Alternative would likely cause local traffic and parking impacts similar to those of the TSM Alternative. In addition, traffic to stations could significantly affect congestion on adjacent streets.

Transit Operations and Ridership

The Transitway/TSM Alternative would provide service comparable to the TSM Alternative. However, transit speeds and reliability would be improved, particularly along I-5, SR-518 to and from Sea-Tac International Airport, and through downtown Bellevue. Since these areas are often transit "choke points," these improvements would increase the efficiency of the regional system. As a result, the Transitway/TSM Alternative could deliver more service in the same amount of time. However, because of difficulties in getting into and out of the University District from the transitway, transit service to the University District would become less efficient, which is reflected in a reduction in ridership to the University District as compared to the TSM Alternative.

Platform miles and hours under the Transitway/TSM Alternative are similar to those for the TSM Alternative. Service miles increase slightly due to improved speeds. Significant changes include a shift to more express and less local mileage. Other major changes include an all-day express route from Everett to Tacoma through downtown Seattle. Another express route would connect South Everett to Bellevue. Some Rainier Valley routes would extend to connect with the transitway at Boeing Access Road. Some SR-520 routes would be rerouted onto the I-90 busway, increasing travel times for those routes.

Accessibility. Accessibility for transit riders would be improved by increased speed and reliability of service and improved transit connections to regional routes, particularly from Rainier Valley, Bellevue, SeaTac, and Snohomish and Pierce counties, due to service changes not included in the TSM or No-Build Alternatives. For example, transit riders could reach Everett and Paine Field more quickly because of direct service along I-5.

Accessibility of employment centers by transit from low-income areas would also increase under this alternative, both relative to 1990 and to the No-Build Alternative. Transit travel times to employment centers outside Seattle from low income areas in Seattle, Everett, and Tacoma would decrease by about 5 percent from 1990 and be about 9 percent lower than for the No-Build Alternative. However, reaching many of these centers from low-income areas would still require very long transit trips.

Transit System Ridership and Transfers. Ridership would be 480,000 daily and 135.4 million annually. Ridership would be 69 percent higher than in 1990 and 22 percent higher than under the No-Build Alternative (see Table 3.9.4). Fifty-eight percent of ridership growth is due to regional growth. Twenty-four percent is due to increases in transit service and 18 percent is due both to the improved transit travel times and to changes in highway congestion and parking costs. As shown in Table 3.9.5, ridership would increase only slightly more than population growth. The projected Transitway/TSM transfer rate is higher than the 1990, No-Build, and TSM rates. This is due to much improved service frequency, which would facilitate transfers. Some restructuring of routes under the Transitway/TSM Alternative would also increase transfers.

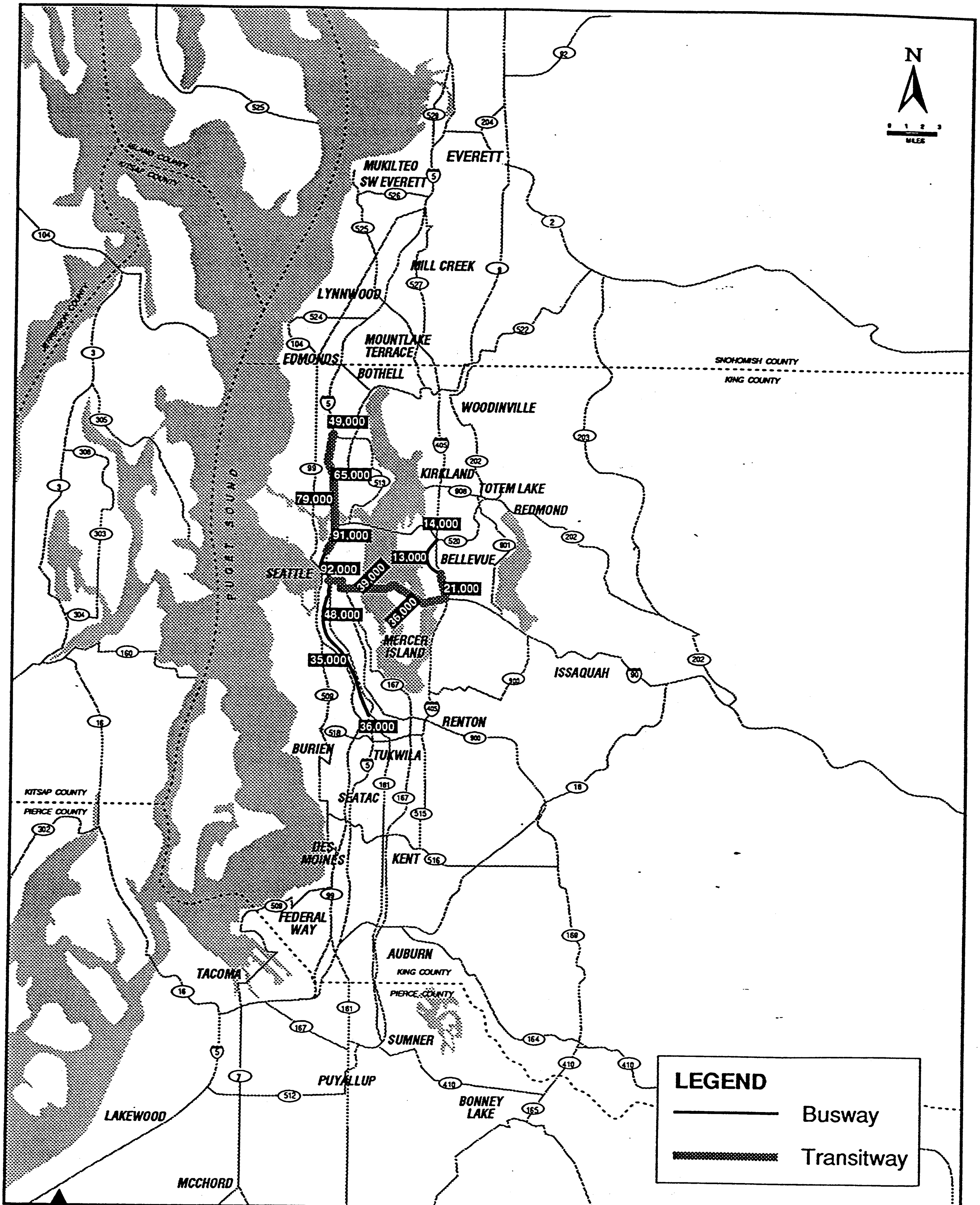
Transit Ridership By Corridor. As compared to the No-Build Alternative, there would be an additional 39,000 transit trips in the North Corridor, 37,000 trips in the South Corridor, 12,000 trips in the East Corridor, and 4,000 trips in downtown Seattle. The large increases in the North and South corridors reflect the transit market potential in these corridors and the effect of improving transit service under the Transitway/TSM Alternative.

Transit Ridership By Mode of Access. The mode of access to transit (walk versus drive) would not change significantly (see Table 3.9.7) under the Transitway/TSM Alternative. While new park-and-ride lots would encourage drive-access trips, increased service frequency and coverage would encourage a comparable increase in walk-access trips.

Transit Volumes at Selected Screenlines. The Transitway/TSM Alternative would generate transit volumes similar to the TSM Alternative (see Figure 3.18), generally showing a 10 to 30 percent increase in ridership at specific locations over the No-Build Alternative. The increases range from 8.2 percent on the West Seattle Bridge to 233.3 percent on I-405 near Bothell.

Mode Split. A greater percentage of trips to major centers would be by bus under the Transitway/TSM Alternative than the TSM Alternative (see Table 3.9.8). The University District and downtown Seattle continue to show the highest transit shares. The increase reflects the greater emphasis placed on transit in the Transitway/TSM Alternative.

Transitway Daily Transit Passenger Volumes. The greatest passenger volumes would occur in downtown Seattle with 92,000 daily trips (Figure 3.19). Ridership between downtown Seattle and the University District would be 91,000 per day. The remainder of the North Corridor, with 49,000 to 79,000 daily trips, leads the region in transitway ridership. The South Corridor would have 48,000 daily riders through the Duwamish Valley and 35,000 to 36,000 riders in the rest of the corridor. 36,000 to 39,000 daily riders would cross the I-90 floating bridge into downtown Seattle. The



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2020 Daily Transitway Passenger Volumes

System Plan EIS

FIGURE 3.19

remainder of the East Corridor through Bellevue would draw between 13,000 and 21,000 daily riders.

Other Transit Modes

The Transitway/TSM Alternative would be similar to the TSM Alternative in the connections it would make to other transit services. Travel to intercity bus, rail, and ferry terminals in Tacoma, Seattle, and Everett would be somewhat quicker and more reliable than under the TSM Alternative.

Bicycle and Pedestrian Circulation

Measures to improve bicycle circulation would be similar to those for the TSM Alternative, including transporting bicycles on feeder and regional bus routes. In addition, stations would include weather-protected bicycle storage and bicycle access improvements within 1/4 mile of stations. During the project-level phase, consideration would be given to including bicycle paths within transitway alignments. These measures would greatly enhance the connections between bicycles and transit.

Measures to improve pedestrian access to transit would also be similar to those for the TSM alternative.

Relationship to Commute Trip Reduction

Service increases under this alternative would provide some support to commute trip reduction efforts, particularly outside downtown Seattle. Completion of the HOV system and provision of arterial HOV improvements would also provide incentives for increasing vanpooling and carpooling.

3.9.3.4 Rail/TSM Alternative

The rail system would stretch from Everett to Tacoma on both sides of Lake Washington with spur lines to Redmond, Issaquah, and Burien. The alternative would include a commuter rail line through the Green River Valley from Seattle to Tacoma and bus service based on the TSM Alternative. The system would have no at-grade crossings, except on the commuter rail line and possibly in Snohomish County and Tacoma, increasing speed and reliability.

Transportation Infrastructure

Electric rail lines, even those in existing rail rights-of-way, would run on exclusive tracks and would not affect existing rail operations.

The I-5 rail alignment would remove traffic from two of the I-5 reversible lanes and close the 42nd Street ramp to the University District.

Electric rail operations on reinforced steel concrete structures, such as the I-90 bridge or the I-5 express lanes, could induce stray electric current into the structures. By increasing corrosion, stray current could reduce the lifetime of the structures and increase overall maintenance costs.

Dual-power buses presently operating in the downtown tunnel would be displaced onto downtown Seattle surface streets as rail operations were phased into the tunnel. Because these vehicles are somewhat heavier than other articulated buses, they would increase wear on downtown streets until they were replaced as their useful life came to an end.

Traffic Volumes

The Rail/TSM Alternative provides the lowest regional traffic volumes of the alternatives (see Table 3.9.3). Overall vehicle trips, VMT, and VHT would be 3.7 percent to 6.2 percent less than under the No-Build Alternative. Vehicle trips at screenlines would be reduced by 1 to 5.8 percent. Use of rail would totally remove these vehicle trips from the freeway system. This reduction would not have a major effect on traffic congestion, since traffic levels would still increase from 1990. But it would provide a significant choice for travel in the region. There would also be noticeable effects on peak hour traffic to and from downtown Seattle and the University District. As under the TSM Alternative, completion of the regional HOV system would also improve circulation for carpools and vanpools.

However, the I-5 alignment in the North Corridor would reduce the capacity of the I-5 ship canal bridge, causing significant traffic problems on I-5 and diverting significant amounts of traffic to north-south arterials in North Seattle. Automobile travel time for commuter trips to downtown Seattle would probably increase.

The rail alignment would affect general traffic operations on I-90 between downtown Seattle and Bellevue. HOV traffic and general-purpose Mercer Island traffic would be displaced from the center roadway. Replacing the center roadway with outside HOV lanes, although feasible, would require a significant departure from federal interstate standards for lane and shoulder widths. Accidents would be somewhat more likely and incidents such as accidents and breakdowns would have a greater effect on traffic congestion.

As under the TSM Alternative, reductions of traffic under the Rail/TSM Alternative would have significant beneficial effects on some congested intersections. Since the reduction is greater under the Rail/TSM Alternative than under the TSM Alternative, this effect would probably be more widespread than for the TSM Alternative.

However, this alternative could have adverse local traffic impacts, particularly at park-and-ride stations. Traffic to stations could significantly affect congestion on adjacent streets and adversely affect access to stations by buses and nonmotorized modes. This could be particularly true of interim and permanent terminal stations. Terminal stations would serve as collectors for the system and would probably generate a large amount of auto and transit traffic. While permanent terminal stations would likely be sited to minimize traffic disruption, interim terminals, that is, stations that served as the end of a rail corridor while the next segment of the line was being built, might not be well-sited as termini and could have significant, although temporary, traffic impacts.

Placing the rail alignment and associated park-and-ride lots along SR-99 rather than I-5 in the North Corridor north of Northgate and the South

Corridor south of SeaTac could increase traffic volumes on local east-west arterials between SR-99 and I-5.

The option of at-grade alignments with at-grade crossings is currently being considered in Snohomish and Pierce counties, near the ends of the lines. At-grade crossings of intersections would likely increase traffic congestion and the risk of accidents between trains and other modes of transportation. If an at-grade alignment is proposed in these areas, traffic and risks of accidents would be further evaluated during project-level planning.

Attempts to limit parking supply in centers and on transit corridors could result in spillover effects on adjoining residential streets. Similarly, increased transit and new rail service to suburban park-and-ride lots could result in parking spillover onto residential streets if park-and-rides were not sized large enough to handle demand.

Transit Operations and Accessibility

Rail Operations. The rail system would provide frequent service. The average speed from a terminal station to downtown Seattle would be 30 to 35 mph. This compares to an average speed of 15 to 20 mph for express bus service under the No-Build Alternative. Figure 3.20 indicates how the system might operate in the year 2020, including the anticipated service frequency during peak periods. Off-peak headways, except for commuter rail, would be one and a half times peak headways, while service in the early morning and late night would be every 20 minutes. The commuter rail line would run every 15 minutes during peak periods.

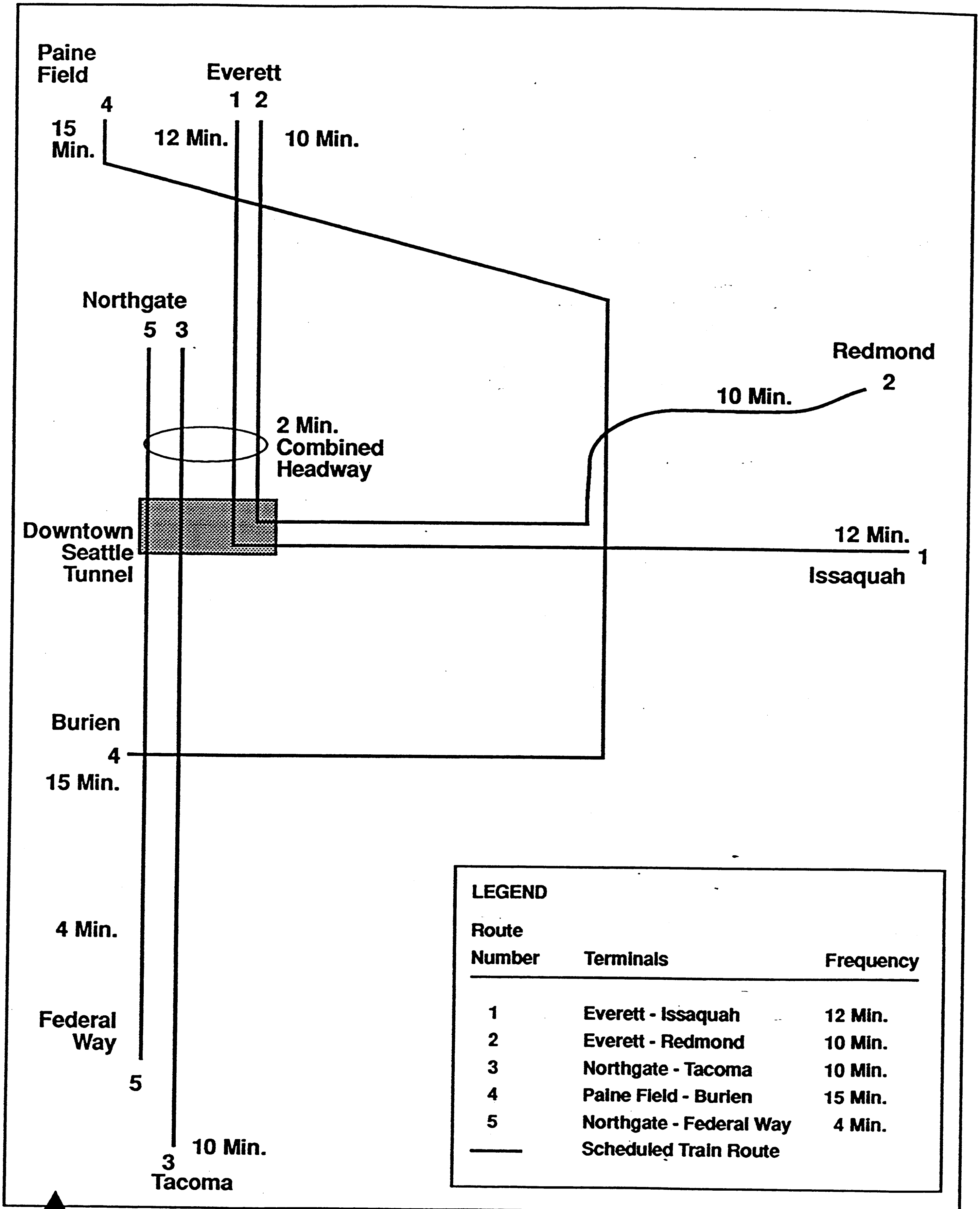
Bus Operations. The Rail/TSM bus system is based on a modified TSM Alternative network. Modifications include:

- truncating or deleting routes that duplicate rail service
- modifying routes that pass close to proposed stations to serve those stations
- adding new routes to rail stations from areas unserved by the TSM bus network.

Routes that would be truncated or deleted include those providing express service along I-5, I-90, I-405, SR 520 east of I-405, and, if the JRPC recommended alternative is selected, Rainier Avenue. In the North Corridor, new circulator routes would operate to Everett rail stations. In the East Corridor, a new route would operate from Totem Lake and Kirkland to the University District. In the South Corridor, new routes in Pierce County would operate to rail stations from Bonney Lake, Lakewood, Olympia, and Fort Lewis. As under the TSM Alternative, east-west service would be strengthened with added frequency and new routes.

Current or planned bus routes in the downtown Seattle tunnel that were not replaced by the rail system would be displaced onto downtown Seattle surface streets, increasing travel time for these routes. However, these increases in travel time would be more than offset by decreases in travel time for other passengers, resulting in a net reduction in travel.

Accessibility. Accessibility for transit riders would be significantly improved by the increased speed and reliability of rail service and the increase in



Route Number	Terminals	Frequency
1	Everett - Issaquah	12 Min.
2	Everett - Redmond	10 Min.
3	Northgate - Tacoma	10 Min.
4	Paine Field - Burien	15 Min.
5	Northgate - Federal Way	4 Min.
———	Scheduled Train Route	

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2020 Conceptual Rail Service Plan
System Plan EIS
FIGURE 3.20

service over the TSM Alternative. Of all the alternatives, the Rail/TSM Alternative would reduce transit travel times the most (see Table 3.9.2), due to greater frequency and speed and better connections between major centers along the I-5, I-405, and I-90 corridors outside downtown Seattle, especially in the off-peak direction.

Accessibility of employment centers by transit from low-income areas would significantly increase under this alternative, both relative to 1990 and to the No-Build Alternative. If the recommended Rainier Valley alignment is chosen, accessibility would particularly increase for the low-income population in that area. Transit travel times to employment centers outside Seattle from low income areas in Seattle, Everett, and Tacoma would decrease by about 28 percent from 1990 and be about 32 percent lower than for the No-Build Alternative. More employment centers would become reasonably accessible by transit, without a need to take very long trips.

Transit System Ridership and Transfers. Ridership under the Rail/TSM Alternative would be 560,500 per day or 157.3 million annually (see Table 3.9.4). This is 96 percent higher than 1990 ridership, 44 percent higher than under the No-Build Alternative, 18 percent higher than under the TSM Alternative, and 16 percent higher than under the Transitway/TSM Alternative. Only 42 percent of the increase under the Rail/TSM Alternative is due to growth in population and employment. Eighteen percent is due to changes in highway speeds and parking costs, while 40 percent is due to improved transit service. As shown in Table 3.9.5, ridership would substantially outpace population growth. Annual trips per capita would be 26 percent higher than in 1990.

The transfer rate for the Rail/TSM Alternative would be 1.5, the highest of the alternatives, because of greater transit frequencies serving transfer points, such as downtown Seattle, transit centers, and park-and-rides. In the model used for forecasting ridership, bus routes were truncated only if total system ridership would not decline. Therefore, most transfers would be "opportunistic" rather than "forced;" i.e., the bus-rail transfers are *permitted* to occur rather than *required* to occur. In other cities with rail, higher transfer rates are typically caused by bus networks that were developed specifically to feed the rail system.

Transit Ridership By Corridor. Transit ridership would increase over the No-Build Alternative 46 percent or 65,000 per day in the North Corridor, 60 percent or 20,000 in the East Corridor, 56 percent or 55,000 in the South Corridor, and 27 percent or 32,000 trips in downtown Seattle, illustrating a dramatic increase in transit level-of-service (see Table 3.9.6).

Transit Ridership By Mode of Access. Seventy-four percent of riders would reach the transit network by walking while 26 percent would drive, an increase in drive access over the No-Build Alternative. This is due to the emphasis on transit stations, rail stations, and park-and-ride facilities under the Rail/TSM Alternative.

Transit Volumes at Selected Screenlines. Increases in transit ridership at screenlines range from a low of 24 percent to a high of over 900 percent as compared to the No-Build Alternative. The largest increase would occur on I-405 near Bothell. The smallest increase would occur across the West Seattle Bridge. Ridership at the other screenlines would increase 38 to 88

percent over the No-Build Alternative. These ridership increases result from the higher level of transit service provided by the rail system.

Mode Split. The transit share of work trips would be significantly higher than under the other alternatives (see Table 3.9.8). The University District and downtown Seattle would still be the most transit-oriented centers, but Northgate, downtown Bellevue, Renton, and Tukwila also would have strong transit ridership. The significant increase in transit's share directly reflects the improved service offered by a rail system.

Daily Rail Passenger Volumes. For the recommended alignments, the highest passenger volumes are expected in downtown Seattle with 124,000 daily passengers (Figure 3.21). The second highest volume would be between Capitol Hill and the University District with 105,000 daily passengers. Daily passenger volumes greater than 50,000 are also expected between the University District and North Seattle and between downtown Seattle and Boeing Field. Passenger volumes between Seattle and Bellevue would total about 40,000 daily trips. Passenger volumes drop below 30,000 north of Montlake Terrace, east of Bellevue, and south of the Kent/Des Moines area.

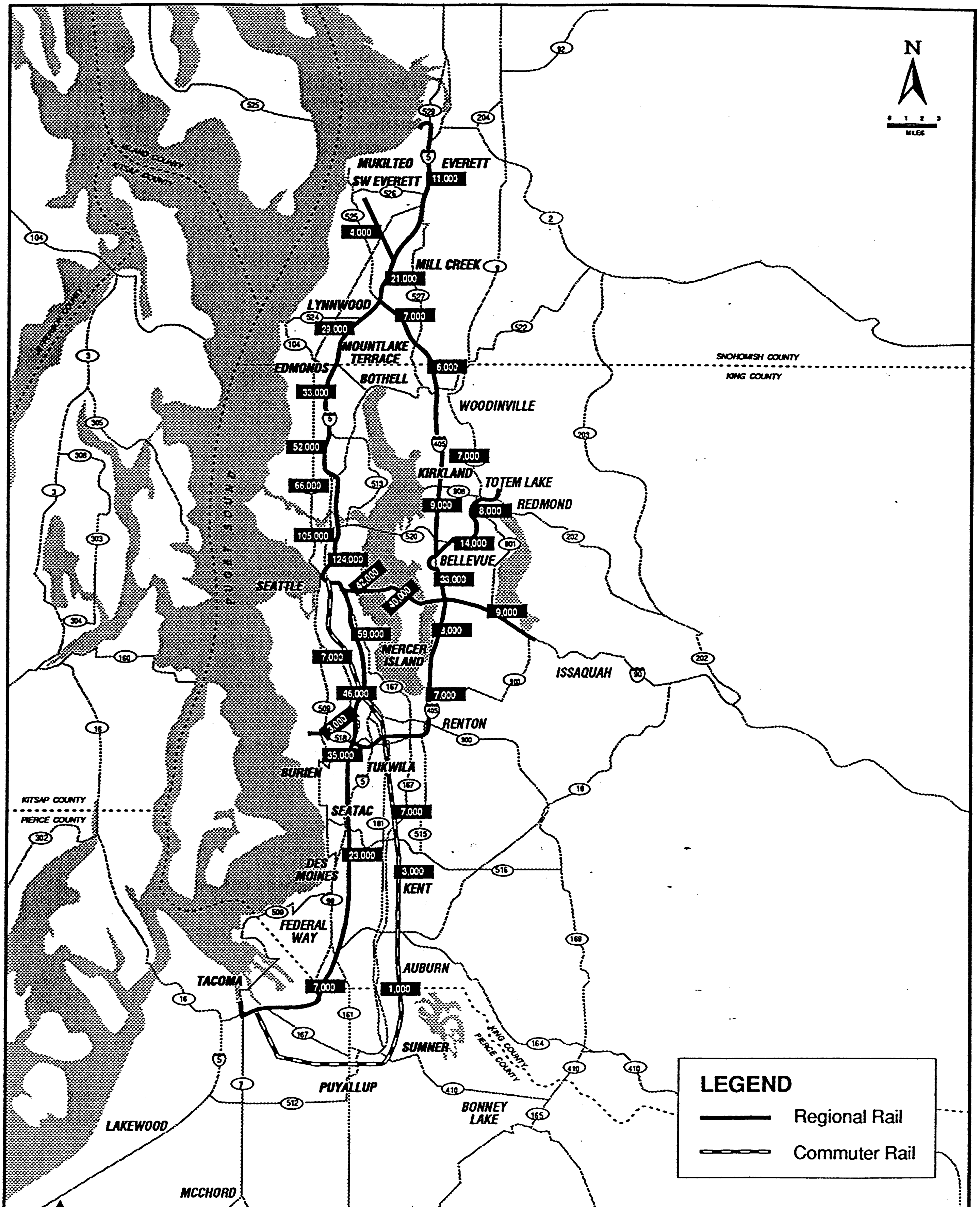
Ridership on the I-5 alignment in the North Corridor would be less than the Capitol Hill alignment by 27,000 trips per day. Ridership on the Duwamish alignment in the South Corridor would be less than the Rainier Valley alignments by 13,000 trips per day. The choice of alignment would not affect ridership north of the University District or south of Boeing Access Road.

Phasing and System Ridership. Because the rail system would be built over a period of years, system ridership could be affected by land use decisions and development that occurs outside the areas served by the initial rail segments. To the extent that potential station areas are developed in a transit-friendly way prior to being served by rail, overall system ridership will be increased when rail lines reach these areas. The policies of RTP to coordinate with local jurisdictions to preserve rail right-of-way and encourage denser development in selected potential station areas should have the effect of increasing ridership in suburban areas beyond that estimated in the ridership modeling. In addition, the willingness of local jurisdictions to institute transit-friendly land use and parking policies will increase the likelihood that these areas will be served by the rapid transit system.

Commuter Rail Element

Commuter rail would operate approximately every fifteen minutes in the peak period and as needed in the off-peak period. The commuter rail line would carry 1,000 to 7,000 passengers per day, with the highest ridership occurring between Kent and downtown Seattle. This would remove about 700 to 750 automobile trips per day. Operations would be coordinated with freight and, if necessary, Amtrak operations. No significant conflicts are expected to occur. Operations could cause significant increases in automobile traffic at some stations. General surface traffic could be affected at grade crossings during peak hours, increasing congestion and risks of accidents.

A joint analysis by the Port of Seattle and Metro has indicated that commuter rail operations would not adversely affect freight operations



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2020 Daily Rail Passenger Volumes

System Plan EIS

FIGURE 3.21

between Tacoma and Seattle. Commuter rail would be implemented in such a way as to preserve needed freight capacity for the foreseeable future. WSDOT is also making significant investments in track, signal, and grade crossing improvements over the next decade that could significantly benefit rail operations.

Other Mass Transit Modes

The rail system and TSM improvements would significantly enhance connections to intercity bus and rail lines, ferry service, and Sea-Tac Airport. It would reduce the need to use automobiles to reach these facilities. The increased speed and accessibility provided by the system would increase walk-on ferry traffic, reducing the need to expand ferry vehicle capacity. The system may have an adverse effect on airporter ridership and intercity bus ridership between Tacoma, Seattle, and Everett.

Bicycle and Pedestrian Circulation

Bicycles would be carried on feeder and regional bus routes and rail lines, consistent with operating safety, service quality, and passenger comfort. Stations would include safe and convenient bicycle access. Station and park-and-ride lots would include weather-protected bicycle storage. Bicycle access and storage improvements within 1/4 mile of stations and along arterials with HOV improvements would also be included. Rapid transit facilities would be designed to avoid blocking current pedestrian and bicycle access across rights-of-way. During the project level phase, bicycle paths would be built adjacent to rail alignments where feasible. All of these improvements would facilitate use of bicycles for regional trips and encourage less use of single-occupant vehicles.

Measures to improve pedestrian access to the transit system would be similar to those for the TSM Alternative and would have a beneficial effect on transit ridership and on reduction of SOV use.

Relationship to Commute Trip Reduction

Service increases under this alternative would support commute trip reduction efforts throughout the region. Completion of the HOV system and provision of arterial HOV improvements would also provide incentives for increasing vanpooling and carpooling.

3.9.4 Mitigation Measures

3.9.4.1 Construction Impact Mitigation

The RTP would work with local jurisdictions and neighborhoods to reduce local construction impacts. Mitigation for traffic impacts could include warning motorists and neighborhood residents of construction areas and designating alternate routes. Detour signing, normal construction safety actions, and a detailed traffic impact mitigation plan would be required.

The RTP would also work with BN and/or UP to mitigate construction impacts on their operations.

For the Transitway/TSM Alternative or the I-5 alignment of the Rail/TSM Alternative, the RTP could institute major trip reduction programs to mitigate the effects of eliminating two or all of the I-5 reversible lanes, including incentives to take transit, additional service and park-and-rides, and public education campaigns. The RTP could fund street improvements in local neighborhoods to discourage traffic diverted from I-5 in those neighborhoods. For the Transitway/TSM Alternative, congestion pricing could allow subscribing SOVs to use the transitway, thus increasing capacity.

Regional impacts of building the Rail/TSM Alternative could be mitigated by carefully phasing construction to minimize local and regional traffic impacts. As much as possible, all construction in a given location should be done at the same time to avoid future disruptions. Each construction task should be completed as quickly and efficiently as possible. Lane closures should take place during off-peak traffic periods to minimize peak-hour disruption. Where construction noise was not an issue, work could continue on weekends and after normal working hours to reduce traffic disruption.

Traffic disruptions on freeways could also be reduced by public information measures, including publicity about the location of construction and advice about alternate routes and a construction location hotline for motorists. Traffic along construction routes could be reduced by providing special transit service and vanpools to carry travelers through construction areas. In cooperation with WSDOT and local jurisdictions, the RTP could institute an incident management program to speed up response to freeway incidents causing congestion, thus improving the effective capacity of roadways during the construction phase.

In the South Corridor, early implementation of commuter rail would mitigate traffic impacts by providing an alternative means of reaching downtown Seattle from Pierce County and south King County.

3.9.4.2 Mitigation of Operations Impact

The build alternatives would, for the most part, benefit regional transportation and mitigate current mobility problems. However, stations and park-and-ride lots could have local traffic impacts. The RTP would work with local jurisdictions, communities, and neighborhoods to identify appropriate mitigation during project-level environmental review. Mitigation might include improving local roadway capacity, street enhancements to keep park-and-ride or station traffic out of neighborhoods, the use of residential parking zones, charging for SOVs using park-and-ride lots, and increasing feeder buses serving the park-and-ride to reduce the need for additional parking spaces. To enhance pedestrian, bicycle, and transit connections at stations, mitigation could include improving transit connections, improving pedestrian and bicycle facilities on surrounding streets, discouraging automobile traffic, and reducing parking.

RTP will work with local jurisdictions to develop parking management plans for centers and transit corridors. Such plans will reduce the traffic demand generated by rapid transit stations and help to increase transit ridership. Parking management programs will include providing preferential parking for HOVs and charging for parking for SOVs.

Impacts of stray current on reinforced concrete structures could be mitigated with increased inspection and maintenance of these structures.

Traffic impacts of commuter rail stations could be reduced by providing additional small non-park-and-ride stations with limited stop service along the commuter rail route.

3.10 Land Use and Economics

Major transportation improvements, including new rapid transit systems, do not "cause" land use changes or economic development by themselves. New development patterns are produced by complex interactions among many variables, including health of the national and regional economy, balance between transportation and development, land use policies and tax structure, political leadership, and public consensus on a region's future. The link between transportation and land use is strong and it is futile to consider one without the other when we look to the future of our region. Transportation provides the means for us to get to the important places in our lives -- where we live, work, play, go to school and conduct our daily business. Land use shapes the way these places look and feel, and how conveniently we can use our transportation system to get to them. This analysis examines the potential for development and land use change under each of the alternatives, both regionally and around stations. Development may be encouraged where it is desirable or prevented where it is not, depending on the vision and desires of local jurisdictions and communities.

This section considers impacts of the alternatives on land use in the region. Chapter 4 considers the relationship of the alternatives to land use policies and plans.

3.10.1 Affected Environment

3.10.1.1 Land Use, Population and Employment

Employment

In the 1980s, regional employment grew by 34 percent to 1,432,500 (Table 3.10.1). The economy shifted from manufacturing to nonmanufacturing sectors, particularly consumer, producer, and health services and eating and drinking establishments. About 65 percent of regional employment is in services, 17 percent in government, and 16.5 percent in manufacturing.

Table 3.10.1. Estimated Employment, 1980 to 1990.

County	1980	1990	% Change	1990 Share of Jobs
King	758,021	1,004,300	32.1	70%
Pierce	185,623	243,900	31.4	17%
Snohomish	116,582	184,300	58.1	13%
Region	1,060,226	1,432,500	34.2	100%

Source: Population and Employment Forecasts, 1988; Revised in 1990; PSCOG.

Parts of Seattle, Bellevue, and Tacoma have the highest employment densities at more than 100 jobs per acre. Everett and the Tacoma Mall area have more than 25 jobs per acre. Downtown Seattle, Bellevue, and Tacoma and Seattle's University District are the major regional office and commercial centers. Employment is in finance/real estate, health services, trade, producer services, and government (including education). Renton and southwest Everett include industrial centers with employment densities over 25 jobs per acre. Densities in other industrial centers, including Tukwila, Kent, Auburn, and Skyway/Boeing Field, are typically quite low.

Population and Housing

The region's population increased 22 percent from 1980 to 1990 to 2.6 million people in one million households. King County contained 59 percent of that population, with 23 percent in Pierce County and 18 percent in Snohomish County. Households are substantially more dispersed throughout the region than employment. Areas near downtown Seattle and Tacoma exceed 21 units per acre. Densities between five and nine units per acre are found in the oldest Seattle and Tacoma suburbs, close to downtown Bellevue, and near I-5. Most of the region is below five units per acre.

Between 1980 and 1989, occupied housing units increased 24 percent. This trend is expected to continue during the next 30 years (Table 3.10.2). Snohomish County will grow at the fastest rate and King County at the lowest rate. Rapid growth is particularly evident in the new residential developments on previously vacant and rural land. In spite of this rapid housing supply growth, prices have increased. Increased prices and low vacancies mean there is not enough housing to meet the demand. There is growing concern that many communities do not have enough affordable housing for those employed in the community, especially retail and service workers.

Table 3.10.2. 1990-2020 Projected Population, Household, and Employment Growth.

County	Population Growth	Household Growth	Employment Growth
King	45%	57%	63%
Pierce	54%	70%	62%
Snohomish	84%	104%	99%

Source: PSCOG 1990.

In the 1980s, the housing supply grew fastest near suburban employment and shopping centers. Nearly 73 percent of single-family units built in 1988 were in unincorporated areas. Strong housing demand has also caused land conversion and infill in older neighborhoods. For example, in 1989 6.5 new housing units were created in Seattle for each unit removed (PSCOG 1990). Regionally, new multifamily units built have exceeded single family units in every year since 1985.

Housing is considered affordable if housing and utility costs are no more than 30 percent of household income. Average single family home prices far exceed that measure of affordability and the number of affordable housing units is declining. At the same time, the number of poor families has increased and their average income has declined. It takes a wage 230

percent higher than minimum wage to pay the average rent in Washington State (PSCOG 1990).

There are also significant differences for housing prices and rental rates within the region. For example, rents in Pierce County are 26 percent lower than in King County. Within King County, certain areas, such as the Green River valley and Rainier Valley, contain most of the affordable housing. This may change by 2020 due to growth management policies encouraging a wider distribution of affordable housing.

Housing costs are determined largely by the interaction of supply and demand. However, other factors significantly affect both supply and demand, such as interest rates and land availability. At the local level, housing costs are affected by location, access to employment, neighborhood amenities or disamenities, and the availability of public facilities. Not all of these factors are straightforward in their effect on prices. For example, being close to centers can involve disamenities, such as high levels of traffic, even though employment access is an advantage. Similarly, while compact residential development generates lower land costs, housing units may not be more affordable, due to higher construction costs or the nature of demand in a submarket.

Land Use and Employment Centers

North Corridor. The highest densities are between downtown Seattle and Northgate, with multi-family and high-density single-family units, concentrated retail, and the University of Washington. Northgate and Lynnwood are smaller retail/office areas separated by low-density suburban housing. Everett has medium to high density commercial, residential, and institutional uses. Major employment centers include downtown Seattle, University District, Queen Anne, First Hill, Ballard, Northgate, Edmonds, Lynnwood, southwest Everett, downtown Everett, and Marysville. Southwest Everett is expected to become a primary employment center in the state.

South Corridor employment centers include the Duwamish valley, downtown Renton, Tukwila, SeaTac, Kent, Auburn, Federal Way, downtown Tacoma, Puyallup, Sumner, and Lakewood. The Duwamish valley has relatively high-density industrial development. Rainier Valley has medium to high density residential development with some commercial, retail, and industrial uses. Farther south, the I-5 corridor has low to medium density retail and residential development, as well as Sea-Tac Airport. East of I-5, Renton and the Green River valley contain low to medium-density industrial, residential, and agricultural uses and may grow significantly due to major generators such as Boeing. The Puyallup/Fife area and the Tacoma Tideflats are urban areas with low to medium-density industrial, residential and auto-oriented commercial development. Tacoma has relatively high-density residential development, as well as major industrial and retail uses. Downtown Tacoma is a medium to high-density commercial, governmental, and financial center, with an industrial area to the south. The Lakewood area is a commercial and residential area. It is designated as a subregional center in Vision 2020. South of Tacoma, McChord Air Force Base, Fort Lewis, and Madison General Hospital are major employers.

The East Corridor has dispersed commercial, office, and industrial activity centers surrounded by low-density housing. Downtown Bellevue is a regional high-density office and commercial center with some high-density residential development. Kirkland has areas of moderate residential density.

Downtown Redmond has moderate-density office, commercial, and industrial development. Factoria, Issaquah, Kirkland, Juanita, Totem Lake, Bothell, and the Bel-Red area have major retail and office uses. Overlake and the I-90 corridor have moderate-density retail and industrial development.

Neighborhoods and Neighborhood Facilities

Neighborhoods are defined residential areas, often surrounding a core of businesses and community facilities. Facilities important to neighborhood health include restaurants, drugstores, grocery stores, schools, libraries, post offices, and churches. Access to facilities and to other residences is crucial in preserving neighborhood integrity, making neighborhoods vulnerable to barriers caused by transportation projects. Some facilities are also sensitive to other impacts, such as noise and vibration.

Employment and Population Trends

Employment and population growth will be slower than in the past 30 years. Nevertheless, by 2020 regional employment will grow by more than 800,000 jobs, virtually all in trade and services. In 2020, those sectors will provide almost two-thirds of the region's jobs. Population will grow by more than a million.

The areas of future employment and population growth depend on local government policies for transportation and land use. Growth pressures are strong in present employment centers, particularly downtown Seattle, Bellevue, Tacoma, and Everett, along freeway corridors, and on the urban fringe.

Because the distribution of growth depends on public policy, PSRC has made two sets of forecasts. While the overall amount of growth will be based on relatively uncontrollable economic patterns, the distribution of growth may change. The *adopted* 2020 forecasts predict regional patterns under presently adopted local land use policies (Figure 3.22). The *Vision 2020* forecasts predict the growth pattern if local jurisdictions adopt strong growth management policies and direct growth into already-existing centers. On a regional level, Vision 2020 would direct more growth to urbanized Pierce and Snohomish counties and reduce growth in King County and rural Snohomish County. The Vision 2020 forecasts will likely prove to be more accurate as counties and local jurisdictions implement growth management policies.

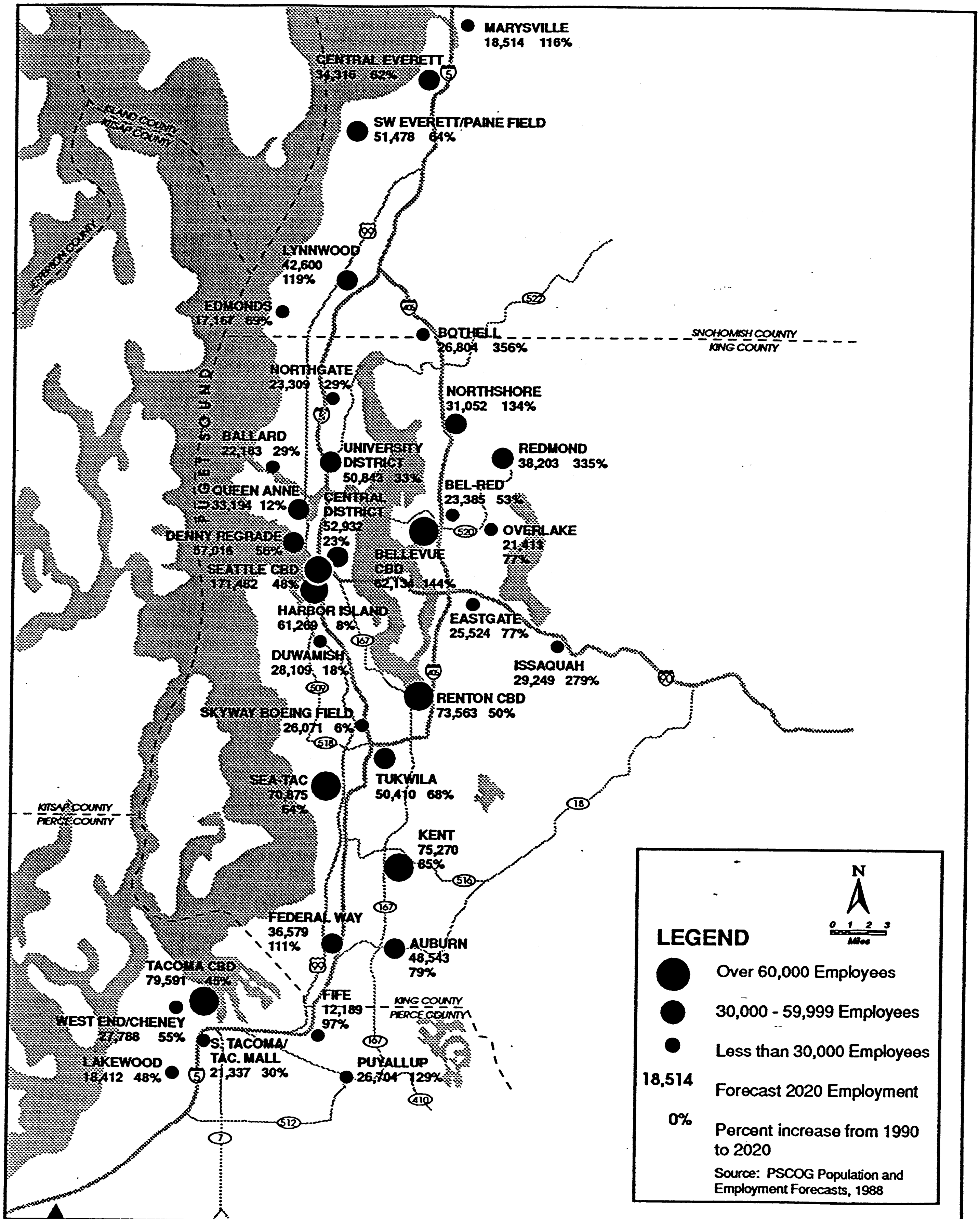
3.10.2 Construction Impacts

3.10.2.1 No-Build Alternative

Construction impacts would be minor. Increases in park-and-ride capacity would be subject to project-level environmental review. This construction would probably not affect land use outside of construction sites.

3.10.2.2 TSM Alternative

The TSM Alternative would need about 175 acres of new right-of-way in the North Corridor, 129 acres in the South Corridor, and 70 acres in the East Corridor (Parsons/Kaiser 1991). About 199 acres would be commercial or industrial and about 174 acres would be in residential areas. Some businesses and residences would be relocated. Construction could disrupt



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2020 Areas of Major Employment
System Plan EIS
FIGURE 3.22

nearby land uses, including temporary access loss, noise, vibration, and dust. Marginal businesses might not survive a long construction period and close or relocate. Residential, educational, high technology, medical, and research uses would be sensitive to noise, vibration, and dust.

The TSM Alternative would cost approximately $4.7 billion. Assuming a proportion of exogenous funding similar to that for the recommended draft System Plan, expenditure of these funds would create approximately 500 construction jobs for the 25-year construction period, as well as 400 jobs in related industries such as manufacturing and transportation. The expenditures of construction funds would generate an additional $2.6 billion of production in the Puget Sound region.

3.10.2.3 Transitway/TSM Alternative

Construction impacts of the Transitway/TSM Alternative would be similar to but slightly greater than those of the TSM Alternative. This alternative would require about 176 acres of land in the north corridor, 212 acres in the South Corridor, and 94 acres in the East Corridor (Parsons/Kaiser 1992b). About 293 acres would be industrial or commercial property and about 190 acres would be residential property.

The Transitway/TSM Alternative would cost about $5.5 billion. Assuming a proportion of exogenous funding similar to that for the recommended draft System Plan, this would create approximately 600 construction jobs for the 25-year construction period, as well as 400 jobs in related industries. The increase in regional income is estimated to be $3.0 billion.

3.10.2.4 Rail/TSM Alternative

The Rail/TSM Alternative would require about 377 acres in the North Corridor, 277 acres in the South Corridor, and 367 acres in the East Corridor, assuming the recommended alignments. The North Corridor I-5 alignment would need about 35 acres less, excluding right-of-way for a University District peoplemover. A Rainier Valley alignment that followed Rainier Avenue rather than Martin Luther King, Jr., Way would require about 4 more acres of right-of-way; the East Marginal Way alignment would require about 4 acres less. Maintenance facilities for the rail system would also probably displace other industrial uses.

Almost three times as much construction would be required for the Rail/TSM Alternative as for the TSM Alternative. Construction impacts could be expected to be proportionately higher. Significant impacts would occur while building underground stations along urban arterials such as Broadway Avenue or Rainier Avenue South, including:

- high levels of noise
- production of dust and diesel exhaust
- mud affecting roadways, sidewalks, and neighboring businesses
- significant traffic impacts due to lane closures and detours.

Traffic, noise, dust, mud, and air emissions from underground station construction would make businesses less attractive to customers and more difficult to visit. Construction could reduce parking supply, require pedestrian detours, and increase costs of delivering and shipping goods, reducing income and increasing costs. Utility disruptions could result in unexpected

temporary business closures. Dust and mud could significantly increase cleaning costs. Some businesses near station areas might fail or move.

The Rail/TSM Alternative would cost about $11.5 billion. Assuming a proportion of exogenous funding similar to that for the recommended draft System Plan, this would create some 1,300 construction jobs for the 25-year construction period and 1,700 jobs in related industries (BRW 1991b) and generate $6.2 billion worth of production in the -region.

Commuter Rail Element

The system would require no additional railroad right-of-way. Construction impacts would be minor. There may be temporary disruption in accessibility for customers and deliveries to businesses.

3.10.3 Operations Impacts

Urban sprawl is generally described as land development which requires the construction of significant new infrastructure occurring at the fringe of the urbanized region before the development of available land which is served by existing infrastructure within the urbanized boundary. In the Puget Sound region, urban sprawl has occurred in two ways. The first form has resulted from rapid growth of smaller cities, which were originally beyond urban boundaries, as bedroom communities for commuters. The second form has involved the acquisition and development of very large tracks of land by a single owner/developer at sites beyond the urban boundary.

Environmental Impacts

The negative environmental impacts associated with sprawl include:

- o reduced accessibility because of difficulty in serving low density with transit
- o highway congestion on suburban roads and freeways
- o increases in automobile VMT, auto emissions and highway noise
- o increases in energy consumption
- o loss of open space, agricultural lands, and wildlife habitat
- o increased surface water runoff and contamination
- o social, economic, or racial divisiveness
- o capital cost of providing new infrastructure and services.

On the positive side, some economists argue that suburbanization, if not precisely urban sprawl, represents the satisfaction of economic desires and thus promotes economic well-being.

Factors Resulting in Sprawl

Factors frequently cited as causes of sprawl include:

- o economic strength of the region
- o desire of many families for single-family homes on larger lots
- o cheaper land costs and thus cheaper housing that are often available at the outer limits of the region
- o low-density zoning
- o flight from problems of the central city

- higher profit and lower risks associated with developments on large tracts of land in single ownership
- growth of employment opportunities in the suburbs
- growth of households with two or more workers and the likelihood that at least one will be working in the suburbs
- high levels of automobile ownership
- the fact that many of the social and environmental costs of driving are not borne by automobile owners
- continuing improvements in the road network
- widespread availability of free parking in suburban locations.

Effects of RTP Alternatives on Sprawl

The most sprawl-resistant of the transit alternatives without long-term growth management actions are likely to be less effective in combating sprawl than would the least sprawl-resistant alternative in tandem with an ambitious growth management program. This is due to the sheer mass and inertia of the existing land use base in the region. No transit alternative will have much of a land use impact unless other complementary actions are associated with it.

Transit system alternatives can help reinforce or hinder efforts to management growth in the region. The likelihood of the various RTP alternatives to have an impact on sprawl are discussed in the sections below.

3.10.3.1 No-Build Alternative

Regional Land Use, Population, and Employment

Under this alternative, transit would not support the goals of Vision 2020 and growth management to concentrate development and curb urban sprawl. Increased densities may not be achievable or desirable without improved transit facilities and service to alleviate traffic congestion near urban centers. Continued traffic congestion could result in effective moratoria on new development.

The pattern of low-density residential development would likely continue. Seattle, Bellevue, Everett, and Tacoma would continue as major urban employment centers. Major employment centers would follow the I-5 corridor and the Green River valley. On the eastside, major centers would extend from Lake Washington to the Sammamish Plateau. Traffic congestion would increase delivery costs and make businesses less accessible to employees, causing some relocation from downtown areas to less congested areas. The supply of affordable housing would tend to be located farther away from centers and costs of housing close to employment centers would increase.

The annual operating and maintenance costs for the No-Build Alternative would be about $274 million (1991 dollars).

Corridor Impacts

North Corridor. Growth in principal activity centers except Everett would be limited by increasing congestion and decreasing accessibility. Low-density infill could occur between centers. Pressure would increase for urban sprawl.

The South Corridor's land use pattern would likely remain the same or intensify. Most changes would occur in present urban areas, although

increasing congestion could add pressure for sprawl and low density growth on the urban fringe toward Puyallup and in rural Pierce County.

East Corridor. Auto-oriented land uses and dispersed land use patterns would remain. Existing activity centers would continue to develop. Limited growth would occur as infill or in areas where road capacities permitted. Pressure for urban sprawl would intensify.

Local Impacts

The No-Build Alternative would have only minor direct local impacts. The few additional park-and-ride lots may discourage nearby residential land uses and increase incentives for auto-related development. Regionally, worsening traffic congestion could lead to lower property values and instability of uses in some neighborhoods.

3.10.3.2 TSM Alternative

Regional Land Use, Population, and Employment

Improvements to the HOV system and increased transit accessibility may help to improve mobility to and from major urban centers, allowing employment growth to continue and reducing commercial traffic costs as compared to the No-Build Alternative. Improved transit mobility would also make lower cost housing more accessible to employment centers.

The TSM Alternative would need about 3,085 more employees than the No-Build Alternative (Table 3.10.3). Annual operating and maintenance costs would be $399 million (1991 dollars).

Table 3.10.3. Operations and Maintenance Employees.

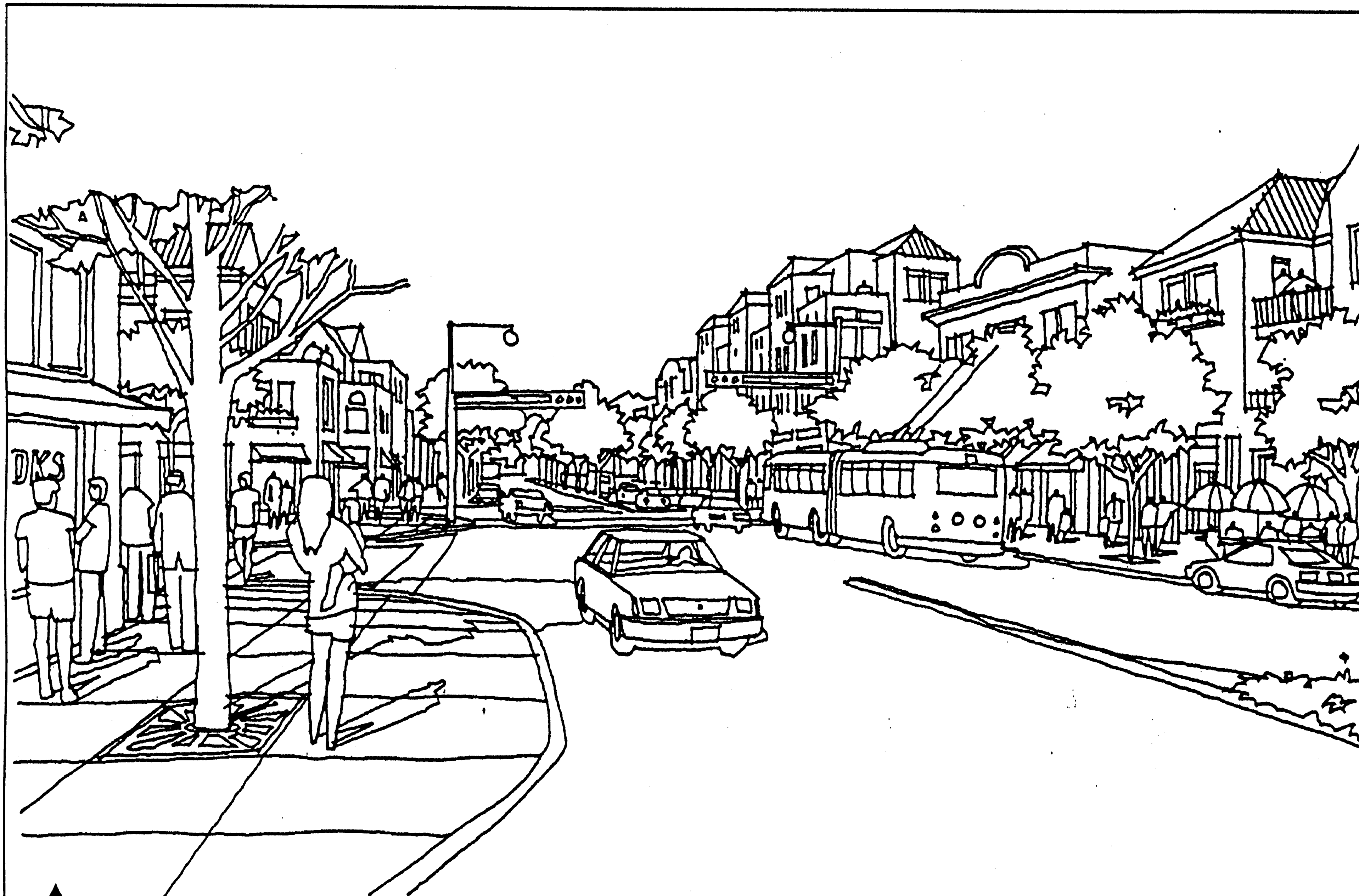
	Alternative			
Transit Provider	No-Build	TSM	Transitway/ TSM	Rail/ TSM
Community Transit	815	1440	1510	1493
Everett Transit	89	169	169	117
Metro	3533	5832	5912	4801
Pierce Transit	513	594	594	465
Rail				2056*
Total	4950	8035	8185	8932

** Includes 211 employees for Tacoma-Seattle Commuter Rail*
Source: Padron 1992.

Corridor Impacts

Services oriented to transit riders and employers in centers where auto access is constrained through traffic congestion or parking costs will benefit from increased transit accessibility, which in turn will increase development opportunities and pressures and transit-supportive land uses (Figure 3.23).

North Corridor. Activity centers along SR-99 and I-5 may have intensified commercial and multi-family development, especially since mixed-use development is being encouraged in the mass-transit corridor centers in Snohomish County. Other new and improved transit access points could also experience pressures to increase densities. Existing low density residential



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Transit Supportive Land Uses
System Plan EIS
FIGURE 3.23

areas would probably not be affected unless located within walking distance of existing or new transit centers or park-and-ride lots.

South Corridor. Capacity increases due to park-and-ride lots and HOV lanes could permit some further land use intensification. Industrial areas in South Seattle and the Duwamish valley that are evolving towards office development could benefit from improved transit access. Activity centers would absorb additional development, especially near new transit hubs and park-and-ride lots.

East Corridor. Additional growth within major activity centers could be supported by improvements to transit systems. Existing low density residential areas would likely not be affected unless they were close to existing or new transit hubs or park-and-ride lots, where pressure may increase for multi-family development or convenience retail services. Large volumes of traffic may also increase pressure for change in the immediate area of park-and-ride lots.

Local Impacts

Employment and population concentrations may increase around major transit transfer points, particularly in urban areas, including Aurora Village, Bellevue, Kirkland, Redmond, Burien, Kent, Auburn, Southcenter, SeaTac, and Renton. However, transfer points at park-and-ride lots near freeway interchanges will not cause much activity center development. Mixed-use development may be encouraged as a matter of jurisdictional policy to reduce trips and increase the convenience and accessibility of transit.

Neighborhood land uses could be affected by new or expanded park-and-ride lots. Traffic congestion, noise, exhaust emissions, negative visual quality, light and glare, and safety and security issues could reduce nearby quality of life, increasing pressure for land use change toward more auto-oriented uses. Operation of new bus maintenance and storage facilities may also affect nearby land uses by increasing traffic and noise.

3.10.3.3 Transitway/TSM Alternative

Regional Land Use, Population, and Employment

Like the TSM Alternative, increased accessibility and supportive land use plans and zoning may encourage employment and population growth in some major centers under the Transitway/TSM Alternative. This effect will be limited because transitways will in general end on the periphery of activity centers. Typically, transitways are not extended into activity centers because every time the buses leave the main line of a transitway to stop, it results in a loss of time savings, defeating the benefits of an exclusive right-of-way for buses. Transitways usually are not very compatible with activity centers, because their structure, which is similar to that of elevated freeways, is intrusive, requires significant amounts of land, and is disruptive to other uses.

Reductions in traffic congestion may reduce commercial traffic costs as compared to the No-Build Alternative. The Transitway/TSM Alternative will have a moderately positive impact on housing supply by further improving access to employment. Housing prices may increase in centers with good walking access to the transitway.

The Transitway/TSM Alternative would need about 3,235 more employees than the No-Build Alternative (Table 3.10.3). Annual operating and maintenance costs would be $406 million (1991 dollars).

Corridor Impacts

North Corridor. Land use impacts are likely to be similar to those of the TSM Alternative, although the addition of park-and-rides and on-line stations could induce moderate land use intensification in activity centers, particularly at Northgate and in south Snohomish County.

South Corridor. Land use impacts are likely to be similar to those of the TSM Alternative, although there may be some moderate land use intensification close to activity centers, particularly south of the Kingdome in Seattle, in the Duwamish Valley, and along the I-5 corridor, where transit access would be improved.

East Corridor. Land use impacts are likely to be similar to those of the TSM Alternative. By improving transit freeway accessibility, the Transitway/TSM Alternative may help intensify development in existing activity centers.

Local Impacts

Transitway alignments would not have major impacts on neighborhoods. Local impacts of stations, park-and-ride lots, and maintenance facilities would be similar to those under the TSM Alternative. There may be a limited increase in residential and employment density near major stations, since the alternative would slightly increase capacity and accessibility over the TSM Alternative. Because areas around on-line freeway stations and park-and-ride lots suffer from increased noise and traffic, they are not likely to be attractive locations for high density residential development.

3.10.3.4 Rail/TSM Alternative

Regional Land Use, Population, and Employment

This alternative has the greatest potential to affect regional land use, population, and employment. Additional rail transit capacity would greatly enhance accessibility to regional centers near transit stations, creating incentives for higher employment and population concentrations in most of the centers designated by PSCOG's Vision 2020 Preferred Alternative, stimulating new development in downtown Tacoma and Everett, and helping define concentrated downtown cores in other emerging urban areas. These station areas could become magnets for office, retail, and high-density residential development, particularly in less dense urban areas. The added transportation capacity may help to relieve pressure for limiting downtown growth in Seattle and Bellevue. Reductions in congestion in these centers may also reduce commercial traffic costs. The Rail/TSM Alternative will thus allow local jurisdictions to focus redevelopment activities in station areas and comply with growth management requirements. Employment centers in the region will become more accessible to low-cost housing areas, but housing prices within centers will tend to increase (BRW 1991g, Parsons/Kaiser 1991e).

Station areas near freeways would be less likely to attract commercial or high-density residential development. In many cases, freeway stations would

be beyond convenient walking distance of a center's downtown and would have a limited tendency to intensify uses.

The Rail/TSM Alternative would require about 3,992 more employees than the No-Build Alternative (Table 3.10.3). The annual operating and maintenance cost would be $492 million (1991 dollars).

Stations with park-and-ride lots located near the urban growth boundaries may encourage some urban sprawl. Park-and-ride lots may also take land near stations that could be used for high-density development, although joint development use of air rights over lots could still be pursued. The existence of such facilities makes it easier for people to live further out, beyond the reaches of transit service. However, the effect on sprawl is unlikely to be significant in relation to existing transportation infrastructure in those areas. A trade-off between encouraging transit-supportive density by limiting the amount of parking spaces at stations and encouraging ridership by providing parking and increasing the draw area of a station should be considered in the design of a system.

Corridor Impacts

North Corridor. The key operational impacts would occur at station locations where transit activities may encourage greater intensification of land uses. Existing communities and neighborhoods, such as the University District, Northgate, Mountlake Terrace, Lynnwood, and Everett could experience pressures to increase densities and types of permitted uses to meet the needs of transit riders. More auto-oriented areas may experience pressure for intensified development around station areas. The pattern of more established denser mixed-use centers would be reinforced.

South Corridor. Pressure for land use change would be greatest where the rail line passes directly through commercial or residential areas. Land use impacts would be limited where rapid rail follows established freeway or rail rights-of-way. Land use could intensify in centers served by rail, including Rainier Valley, SeaTac, Des Moines, Federal Way, Tukwila, Kent, Auburn, and Fife.

Commuter Rail Element. New development, redevelopment or infill, and land use intensification could occur at stations, replacing dispersed auto-oriented land uses. There may be adverse impacts to residential uses near park-and-ride lots. Conversion of agricultural lands in the Green and Puyallup River valleys to other uses could be accelerated as an indirect impact.

East Corridor. Since rapid rail would use established rights-of-way to a large extent, land use impacts would primarily occur around station areas. There may be pressure for changes to mixed uses and greater intensities in these areas, including Mercer Island, Factoria, Bellevue, Overlake, Redmond, Kirkland, Bothell, and Issaquah.

Local Impacts

The potential for station-area impacts to neighborhoods would be greater than under the other build alternatives. In addition, at-grade or aerial alignments may restrict access to some businesses and community facilities.

Urban center stations would emphasize transit and pedestrian connections and typically would not include parking. These stations offer joint

development opportunities (Figure 3.24) and, given concurrence of local jurisdictions, could have high density office, commercial, or residential development. Stations in *activity centers* would be similar, but might also offer parking. In some centers, there might be pressure for development at a scale greater than that envisioned in local plans. Land values could increase, displacing smaller scale or underutilized activities, and making parking development expensive.

Stations in *neighborhoods* could also result in pressure for land use changes as property around stations becomes more valuable. If land use did change, impacts could be either positive or negative. Stable single-family neighborhoods could be adversely affected if change was allowed by the local jurisdiction. A new rail station, in concert with supportive zoning and tax policies, could cause desirable land use changes in unstable, deteriorating, or changing neighborhoods.

Park-and-ride stations would have impacts similar to those associated with bus transit park-and-ride lots, as described for the TSM Alternative. These impacts could decrease the value and desirability of adjacent properties for residential or neighborhood commercial use, unless stations were designed as part of multi-purpose, joint developments. Joint development between private developers and transportation agencies can result in such facilities as office buildings or shopping centers combined with park-and-ride stations.

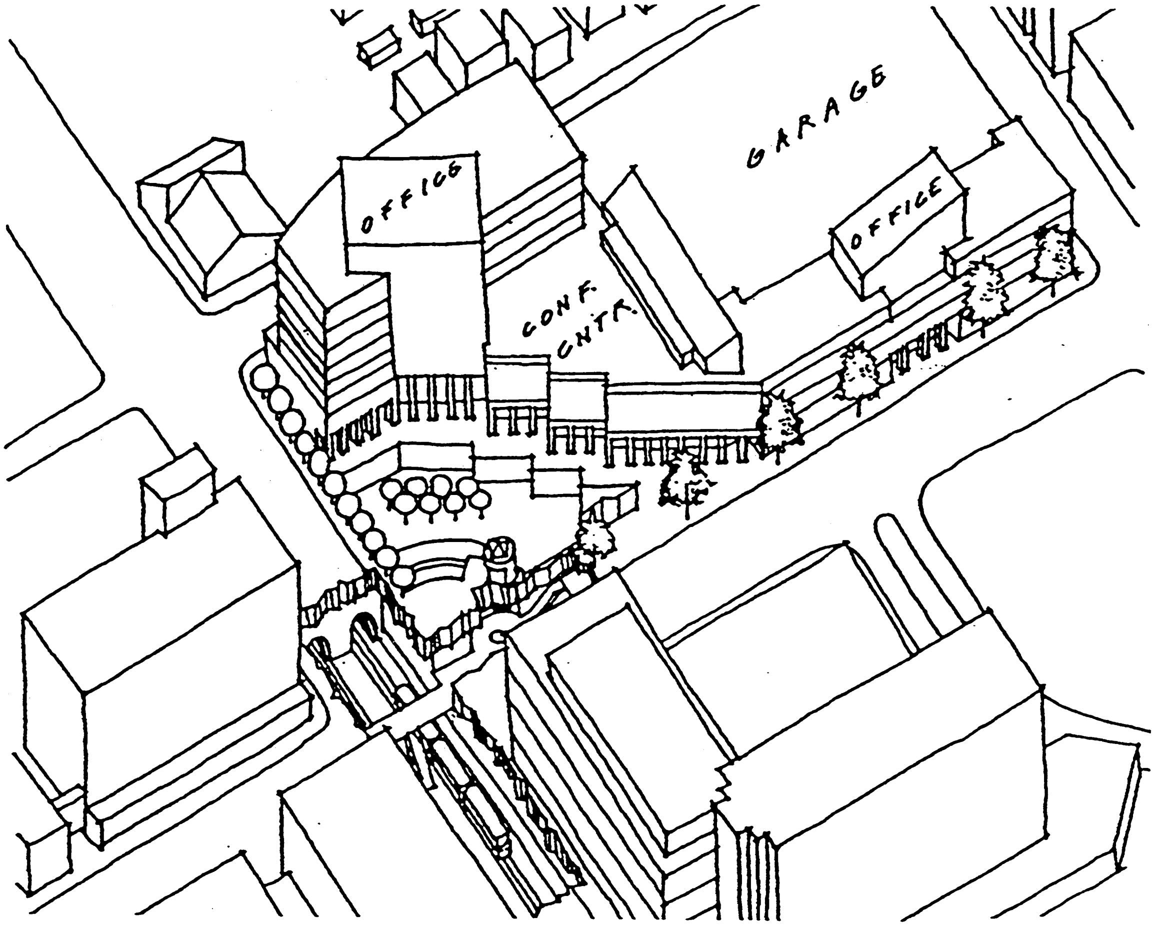
Terminal stations at the temporary or permanent ends of the rail system would have greater land use impacts than other stations, both because they would require land for rail car storage, and because they would be major commuter intercept points, thus increasing local traffic. Land speculation and pressure for service development may occur. These impacts may decrease the desirability of nearby properties for residential or small-scale commercial use. An exception is the commuter rail terminal in downtown Seattle, which could become part of a multi-modal transportation center.

Maintenance facilities would need large areas for rail car storage and movement. Because they would be located in industrial areas, they would probably not affect adjacent land uses.

3.10.4 Mitigation of Impacts

3.10.4.1 Design Process

Transit agencies will work with communities in the design process to minimize development, reduce incompatibilities of design or scale, and provide access across alignments. Such measures could include reduction in station size, design features compatible with surrounding uses, pedestrian amenities, provision or denial of automobile access, and visual corridors around stations and across alignments. If local traffic is increased by a transit facility, transit agencies could provide traffic circles and barriers to keep traffic on arterials and off neighborhood streets. Increased feeder bus service to park-and-ride lots could reduce the required size and scale of these facilities. For a further discussion of land use and station area planning, see BRW (1991).



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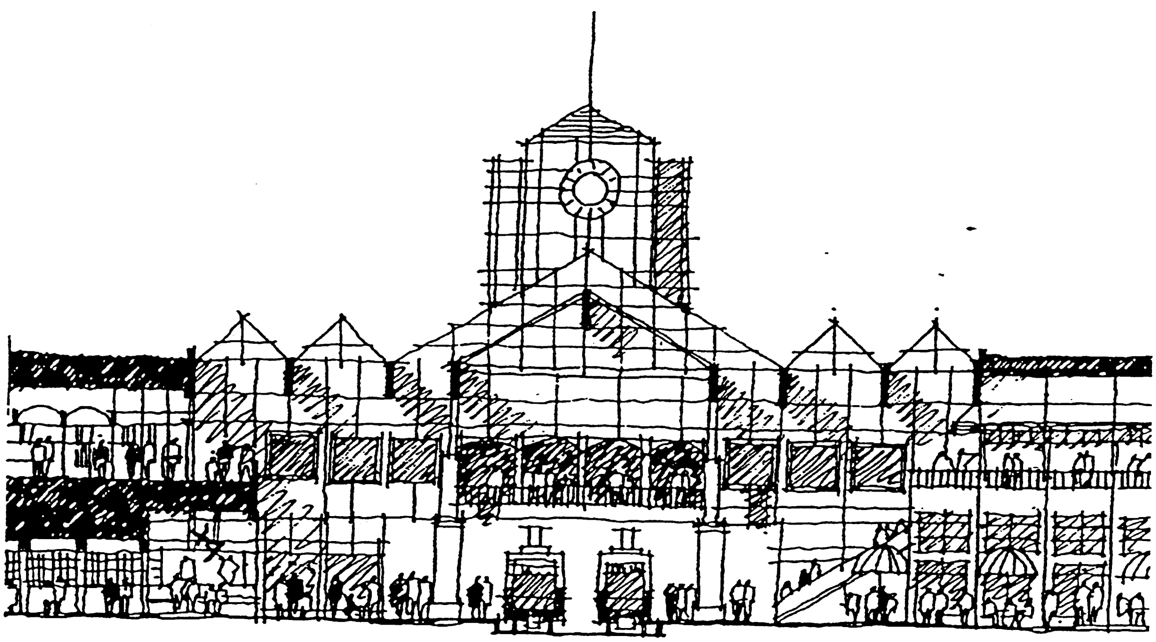

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Example of Mixed-Use Joint Development in Other Cities

System Plan EIS

FIGURE 3.24

3.10.4.2 Land Use Planning

Transit facilities can only induce development with the support of local jurisdictions. Transit agencies will work with local jurisdictions and communities to develop land use plans around stations and park-and-ride lots to promote certain types of development or preserve areas from development. However, in certain areas, particularly near some rail stations, there may be tremendous pressure for changes in land use plans to allow increased development.

Housing price increases in centers can be offset by encouraging higher density affordable housing. Higher density is generally a necessary condition, but it is not a sufficient condition, to achieve affordable housing. The RTP could work with local jurisdictions to include affordable housing in joint development and station area plans and regulatory and incentive programs. The RTP could also help assemble land parcels in centers for affordable residential development.

3.10.4.3 Relocation and Displacement Procedures

During the design process, the exact location of rights-of-way will be determined. Right-of-way acquisition would begin once plans are approved and the project is funded.

The project's acquisition and relocation procedures are based on the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and state law in Chapter 8.26 of the Revised Code of Washington. Any persons displaced from homes, businesses or farms will be provided uniform and equitable treatment.

Properties to be acquired will be independently appraised for fair market value. The U.S. and Washington State Constitutions guarantee that: "No private property shall be taken or damaged for public or private use without just compensation ..." The difference between the market value "before" and the market value "after" is the just compensation. Purchase offers stating just compensation will be made to property owners. If possible, property would be acquired by negotiation. If negotiations fail, property would be acquired by eminent domain.

Eligible individuals, families, businesses, or organizations will receive advisory services and may receive moving costs, housing replacement, rental assistance, or business relocation benefits to minimize hardship and provide the assistance necessary to accomplish this consistently. The program would:

- determine the needs of each person to be displaced
- provide information on comparable replacement properties
- establish eligibility payments and arrange moves.

Various loans and loan guarantees are also available to businesses that can demonstrate need and repay loans and whose preservation will increase or preserve employment. The transit agencies could help businesses determine their eligibility and apply for such loans.

3.10.4.4 Local Impacts

Transit agencies would work with businesses and residents to reduce adverse impacts of facility construction and operation. Construction mitigation could include phasing to ensure preservation of access to adjacent properties; provision of temporary access; compensation for increased expenses (such as cleaning costs); and other measures to reduce noise, air quality, and visual impacts. In addition to mitigation described in the other sections, transit agencies could provide funds for property improvements such as vegetative screening and noise-reducing windows.

If construction of major facilities, such as underground stations, would have significant impacts on commercial areas, the RTP would work with business owners to minimize business loss or provide reasonable compensation. Mitigation plans could include:

- providing temporary replacement parking
- providing shuttle bus and/or increased transit service to affected areas
- providing signage, advertising, and incentives for customers
- compensation for increased costs of deliveries, cleaning, etc.
- making property improvements to reduce construction impacts
- compensating for loss of business during construction
- aid in relocating to another area
- modifying station locations to reduce traffic impacts
- modifying station locations to reduce impacts to sensitive businesses
- suspending construction during the peak retail season
- limiting surface construction to midday, evening or night hours
- making special access provisions for elderly and disabled persons.

3.11 Utilities and Public Services

3.11.1 Affected Environment

Mobile public services, such as police, fire, medical, solid waste, and recycling, and facility-based services, such as medical and educational facilities, post offices, libraries, community and social service eenters, government offices, police stations, jails, solid waste transfer stations, and recycling centers, could be affected by the alternatives.

Affected utilities could include storm and sanitary sewer systems, water distribution systems, gas lines, telephone and other communications systems, and electric utilities. In some areas, there are major subsurface utility tunnels and ducts to consider in determining facility alignments and design. Potential impacts, including the cost of relocations and modifications, will be evaluated in more detail in project-level review.

3.11.2 Construction Impacts

Impacts of construction would differ in degree between alternatives, but the types of impacts would be similar. Construction of any of the "build" alternatives, especially the Transitway/TSM or Rail/TSM Alternatives, could have significant short-term impacts on some public and community services. Access to public services near construction sites may be impeded by traffic restrictions, displacement of parking or loading areas, or other factors.

Permanent relocation may also be necessary, although specific impacts of this type have not yet been determined. Emergency vehicles may also be temporarily impeded along or across roadways directly involved in project construction. Construction of the build alternatives would also generate substantial amounts of construction, demolition, and land clearing waste, affecting solid waste disposal services. The magnitude of impacts would depend on the amount of construction under each alternative.
Utility impacts would also depend on the amount of construction under each alternative. Construction could require substantial relocation of existing utilities. Tunneling and subsurface station construction for the Rail/TSM Alternative would probably generate the most impacts. The alignments and/or structural integrity of many underground utilities near underground alignments and stations are likely to need modification. Some utility relocations and modifications will temporarily disrupt service. These disruptions would be scheduled and announced. Subsurface construction under the Rail/TSM Alternative may also accidentally disrupt water, electrical, communications or other utility service. These disruptions would be unanticipated and impacts could range from minor inconvenience to significant economic loss.

Commuter Rail Element

Relocation or temporary interruption of utilities may be required during track installation. Fiber optic cables in the BN right-of-way may need relocation. Street closures or traffic congestion could impede emergency service access. Construction could make access to public services temporarily more difficult.

3.11.3 Impacts of Operations

While the build alternatives would increase general mobility and accessibility within the region, including to medical and community services, they may also limit or impede access to specific public and community service locations and for police, fire, or emergency medical services if new rights-of-way block direct access to particular areas or if traffic to park-and-ride stations significantly increases levels of congestion. Public service facilities such as libraries, hospitals, and schools could also be adversely affected by increased air pollutants or noise caused by transit system operation. Specific impacts of these types will be identified in project-level planning.

Emergency access to aerial or tunnel alignments will require careful planning and coordination with emergency agencies.

Direct operating impacts on utility services and systems would generally be minimal (see also Section 3.6.3). Indirectly, encouragement of increased densities around transit facilities may increase siting costs for new utilities. The rail system may also produce stray electric currents, possibly corroding pipelines or other metal components of structures. The significance of this problem and appropriate mitigation cannot be addressed in more detail until specific transit technologies and alignments are selected.

Commuter Rail Element

Impacts are expected to be similar to those of operation of the rapid rail line.

3.11.4 Mitigation of Impacts

Project level environmental review of specific alignment and facility locations will identify and evaluate public service facility relocations, significant impacts on access to services, and significant increases in noise or other environmental factors near public facilities. Street closures, detours, or other temporary restrictions of street capacity would be reviewed by local jurisdictions and affected emergency services to ensure maintenance of adequate service levels. Permanent emergency service access changes would preserve the minimum standard of service set by appropriate agencies. Mitigation may include building new access or emergency service facilities or relocating emergency services.

To mitigate impacts on solid waste services, project-level plans and environmental review could include strategies for minimizing waste generation, promoting recycling at rail or transit stations, recycling and disposing of construction, demolition, and land clearing waste generated by the project, and using recycled materials and products during project construction.

Facilities, equipment, and operations will be planned to minimize the likelihood of emergency incidents or need for special security services. Emergency communication systems will be provided, along with plans for evacuation and emergency access.

Construction will be closely coordinated with affected utilities. A plan will be developed for preventing or compensating for unexpected or emergency shutdowns.

3.12 Parks and Recreation

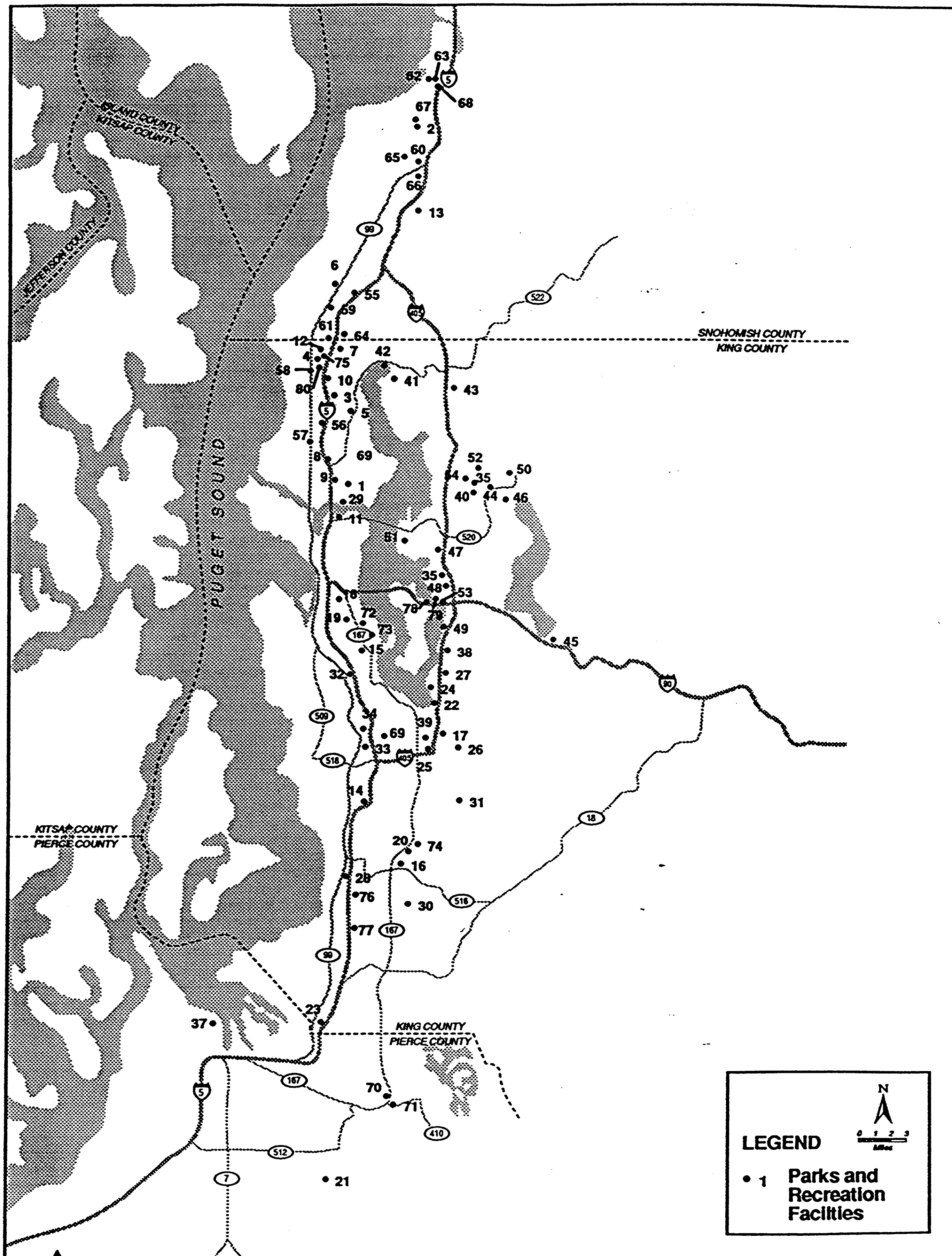
3.12.1 Affected Environment

The region has one of the highest ratios of parks per capita in the nation. Public parks and recreation facilities include large scale regional parks, neighborhood parks, viewpoints, and playgrounds. Recreation facilities include swimming beaches, boat launches and moorage, athletic fields, play areas, trails, fishing piers, stadiums, golf courses, zoos/aquariums, urban plazas, picnic areas, pea patches, and gardens.

Figure 3.25 shows the location of facilities that may be affected by currently proposed rail or transitway alignments or TSM improvements. Table 3.12.1 lists facilities by corridor.

3.12.2 Construction Impacts

Physical separation of parks from users (e.g., fencing of a right-of-way) could alter or restrict access. Construction noise could temporarily affect park quality, particularly if construction lasted in a location more than a few months. New rights-of-ways and other facilities could require taking of land from recreation facilities in the path of, or immediately adjacent to, transit alternatives.



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Parks and Recreational Facilities Near Rapid Transit Corridors

System Plan EIS

FIGURE 3.25

Table 3.12.1. Park and Recreation Facilities.

No.	Potentially Affected Park/Recreation Facility	Jurisdiction	TSM	TW	RAIL
North Corridor					
1	Cowen Park	Seattle			S
2	Everett Country Club	Everett			S
3	Jackson Park Golf Course	Seattle	PS	PS	PS
4	Keogh Park	King	S	S	S
5	Lake City Park	Seattle	S	S	
6	Ballinger Park	Mountlake Terrace			S
7	North City Park	King			PS
8	Rainbow Point Park	Seattle			S
9	Ravenna Boulevard	Seattle			S
10	Ridgecrest Park	King			PS
11	Roanoke Park	Seattle			S
12	Ronald Bog Park	King	PS	PS	PS
13	Thornton A. Sullivan Park	Everett			S
29	Burke Gilman Trail	Seattle	S	S	S
55	Interurban Trail	Lynnwood			S
56	North Acres Park	Seattle			S
57	Evergreen-Washelli Cemetery	Seattle	PS	PS	PR
58	Shorewood High School Facilities	Shoreline School Dist.	PS	PS	PS
59	Scriber Lake High School Playground	Edmonds School Dist.			S
60	Cascade High School Facilities	Everett School Dist.	S	S	
61	Nile Temple Golf Course	Mountlake Terrace			S
62	Downtown/J.J. Hill Park	Everett			PS
63	Judd & Black Park	Everett			PS
64	Veterans Memorial Park	Mountlake Terrace	S	S	S
65	W.E. Hall Park	Everett			PS
66	Cypress Lawn Cemetery	Everett	PS	PS	PS
67	Evergreen Cemetery	Everett			PS
68	Memorial Stadium	Everett School Dist.			PS
69	Roosevelt High School Facilities	Seattle School Dist.			S
75	Twin Ponds Park	King			S
80	North Base Park	King			S
South Corridor					
14	Angle Lake Park	King			S
15	Brighton Playground	Seattle			S
16	Burlington Green	Kent			PS
17	Cedar River Park	King	PS	PS	PS
18	Colman Playground	Seattle			S
19	Columbia Park	Seattle			PS
20	Commons Playfield	Kent			S
21	Firgrove Playfield	Pierce	PS	PS	PS
22	Gene Coulon Mem. Beach Park	Renton			PS
23	Gethsemane Cemetery	Federal Way			PS
24	Kennydale Beach Park	Renton			PS
25	Liberty Park	Renton			S
26	Maplewood Golf Course	King	PS	PS	PS
27	May Creek Park	Renton			PS
28	Midway Park	Kent			PS
30	North Green River Park	King	PS	PS	PS
31	North Soos Park	King	PS	PS	PS
32	Othello Playground	Seattle			S
33	Riverton Park	Tukwila			S
34	Southgate Park	Tukwila			S
37	Larry Frost Park	Tacoma			PS
39	Tonkins Park	Renton			PS
69	Foster Golf Links	Tukwila	S	S	S
70	Gerrard Park	Sumner	PS	PS	PS
71	Sumner Golf Course (planned)	Sumner			S
72	Mount Baker Boulevard	Seattle			PS
73	Rainier Playfield	Seattle			PS
74	Borden Playfield	Kent			S
76	Linda Heights Park	Kent			S
77	Lake Dollof Wetland Park	Kent			S
East Corridor					
35	Anderson Park	Redmond	PS	PS	S
36	Bellefields Nature Park	Bellevue			S
38	Coal Creek Park	King	PS	PS	PS
40	Grass Lawn Park	Redmond	S	S	S
41	Inglewood Country Club	King	S	S	S
42	Kenmore Log Boom Park	King	S	S	S
43	Kingsgate Park	King			S
44	Lagoon Park	Redmond	PS	PS	PS
45	Lake Sammamish State Park	Washington	PS	PS	PS
46	Marymoor Park	King			S
47	McCormick Park	Bellevue			S
48	Mercer Slough Park	Bellevue			PR
49	Newcastle Beach Park	Bellevue			S
50	Bear Creek Park	Redmond	S	S	
51	Overlake Golf Club	Medina	S	S	S
52	Sammamish River Trail Park	King	PS	PS	PS
53	Sweyolocken Park	Bellevue	PS	PS	PR
54	Welcome Park	Redmond	PS	PS	PS
78	Luther Burbank Park	Mercer Island			S
79	Enatai Beach Park	Bellevue			S

S - slight possible impact; PS - potential significant impact (e.g., access or noticeable visual or noise intrusion); PR - potential right-of-way taking

3.12.2.1 No-Build Alternative

No significant impacts to parks are expected under this alternative.

3.12.2.2 TSM Alternative

Equipment, materials and dust from construction of HOV facilities, transit hubs, and park-and-ride lots may temporarily affect access to and usability of adjacent parks. New HOV facilities might also require park right-of-way.

3.12.2.3 Transitway/TSM Alternative

Transitway/TSM Alternative impacts would be similar to those of the TSM Alternative. Transitway construction would not be likely to affect parks; impacts would be due to TSM elements in the alternative.

3.12.2.4 Rail/TSM Alternative

Construction equipment, materials, demolition, clearing and dust may temporarily affect park access, public safety, and usability. New or expanded transportation corridors, stations, and access facilities may require park right-of-way. New transit corridors may affect park access and usability. Transit infrastructure (e.g., wires, rights-of-way, stations) may physically or visually separate parks from neighborhoods. Aerial structures might create a visual barrier. Actual impacts and the number of parks affected would depend on final design and changes in conceptual alignments and elevations. At least a few parks, including Bellevue's Mercer Slough Park and Lynnwood's Interurban Trail, are likely to be affected. Specific impacts would be discussed in project-specific environmental reviews.

Commuter Rail Element

A number of parks are located within a few hundred feet of the Burlington Northern and/or Union Pacific alignments. However, except for the Borden Playfield, Burlington Green and the Commons Playfield in Kent, none of the existing parks are near or adjacent to potential station sites. Construction or operation of commuter rail is not likely to adversely affect access or usability of any parks. Where additional tracks are required, temporary noise and dust impacts may occur.

3.12.3 Operations Impacts

Increased traffic or transit activity near a park could cause changes in access, noise, air quality, and views from the park. On the other hand, the System Plan proposal to include bicycle lanes or trails in plans for HOV lanes and alignments, where possible, could increase recreational opportunities and linear parks in the region.

3.12.3.1 No-Build Alternative

The No-Build Alternative would not have a direct impact on parks, but may increase pressure to develop open space on the urban fringe.

3.12.3.2 TSM Alternative

Where park-and-ride lots are near parks, there may be traffic, noise, and air quality impacts. At the same time, by improving regional mobility, the TSM Alternative will increase accessibility to parks for transit users.

3.12.3.3 Transitway/TSM Alternative

Impacts would be similar to those of the TSM Alternative.

3.12.3.4 Rail/TSM Alternative

In addition to traffic, noise, and air quality impacts of auto-oriented stations and park-and-ride lots, rail lines may have apparent noise impacts when the rail alignment is distinct from other transportation corridors, such as the potential Commercial Avenue alignment in Snohomish County. At the same time, the Rail/TSM Alternative would increase accessibility of parks, particularly those within close walking distance of stations.

Commuter Rail Element

Impacts of increased rail traffic will probably not have a significant impact on parks near to the commuter rail alignment.

3.12.4 Mitigation of Impacts

As shown in Table 3.12.3, many impacts would be minor. However, in some instances there could be significant impacts requiring mitigation.

3.12.4.1 Federal Regulatory Constraints

Section 4(f) of the Department of Transportation Act requires that no prudent and feasible alternative exist to a federally funded project with negative impacts on publicly-owned parks, recreation areas, open spaces, and wildlife and waterfowl refuges and that all possible planning has been done to minimize harm. Steps needed to complete Section 4(f) include:

- Identifying all potentially affected properties
- Analyzing potential impacts, both direct and indirect
- Examining design alternatives that might avoid impacts
- Identifying mitigating measures if design variations prove infeasible.

The chosen System Plan alternative will comply with the 4(f) process.

3.12.4.2 Specific Mitigation

The best mitigation is avoiding parks by adjusting horizontal alignments. Where avoidance is not possible, moving the alignment below grade may lessen or eliminate impacts.

Special construction techniques may minimize impacts to access and usability of parks when building HOV lanes, transitways, or rail alignments. Landscaped berms, noise barriers, or screening can provide visual and

auditory separation, although these may make access more difficult. Grade-separated passages may be used to retain access. Design that is sensitive to neighborhood context, scale, and views may also reduce impacts. If land acquisition is necessary, comparable facilities could be provided in a new location.

3.13 Historic and Cultural Resources

3.13.1 Affected Environment

Archaeological Resources

Settlement of the region's river valleys began after the retreat of the last glaciation about 13,500 years ago. Native American people, such as the Suquamish and Duwamish, occupied various sites, the majority along river banks and shorelines. Any areas where original shoreline has been preserved are likely to contain archaeological resources. Extensive public works projects, including waterfront development, regrading, dredging, river channelizing, and tideflat filling, have disturbed or destroyed much the archaeological record. There are fourteen known archaeological sites within the project area, one in the North Corridor, five in the East Corridor and eight in the South Corridor. Ten are prehistoric, one is historic, and three are Native American from the historic period.

Traditional Cultural Properties

A traditional cultural property is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs in a living community that (a) are rooted in that community, and (b) are important in maintaining community cultural identity. These properties are difficult to identify and often can be ascertained only through interviews or other forms of ethnographic research. Initial research on traditional cultural properties has included consulting with the State Historic Preservation Office and the Governor's Office of Indian Affairs. Tribal groups and representatives of ethnic communities will be contacted once the preferred alignments and station locations are known.

Historic Resources

Permanent Euroamerican settlement of the region began in the 1850s. Population, trade, and manufacturing grew steadily and was energized by the arrival of transcontinental railroad lines in the 1880s. Tacoma based its future on its harbor and railroad connections. Everett gained its reputation as a mill town. Seattle profited as the Alaska gold rush supply center, but aggressive economic diversification made it the foremost city in the region. Smaller communities often developed as agricultural, logging, fishing, or mining centers, depending at first on water transport and communication. Later, roads and rail lines connected outlying towns to major centers. Evidence of early Euroamerican settlement remains in cities such as Bothell, Edmonds, Redmond, Renton, Kent, Auburn, and Puyallup.

Because of extensive human habitation, long-term settlement patterns, and alteration of landforms, construction of an extensive project is likely to uncover both prehistoric and historic resources. Archaeological sites and historic properties must be carefully considered in assessing the effects of any action. Figure 3.26 indicates important individual landmarks and areas with concentrations of historic properties.

Preservation Programs

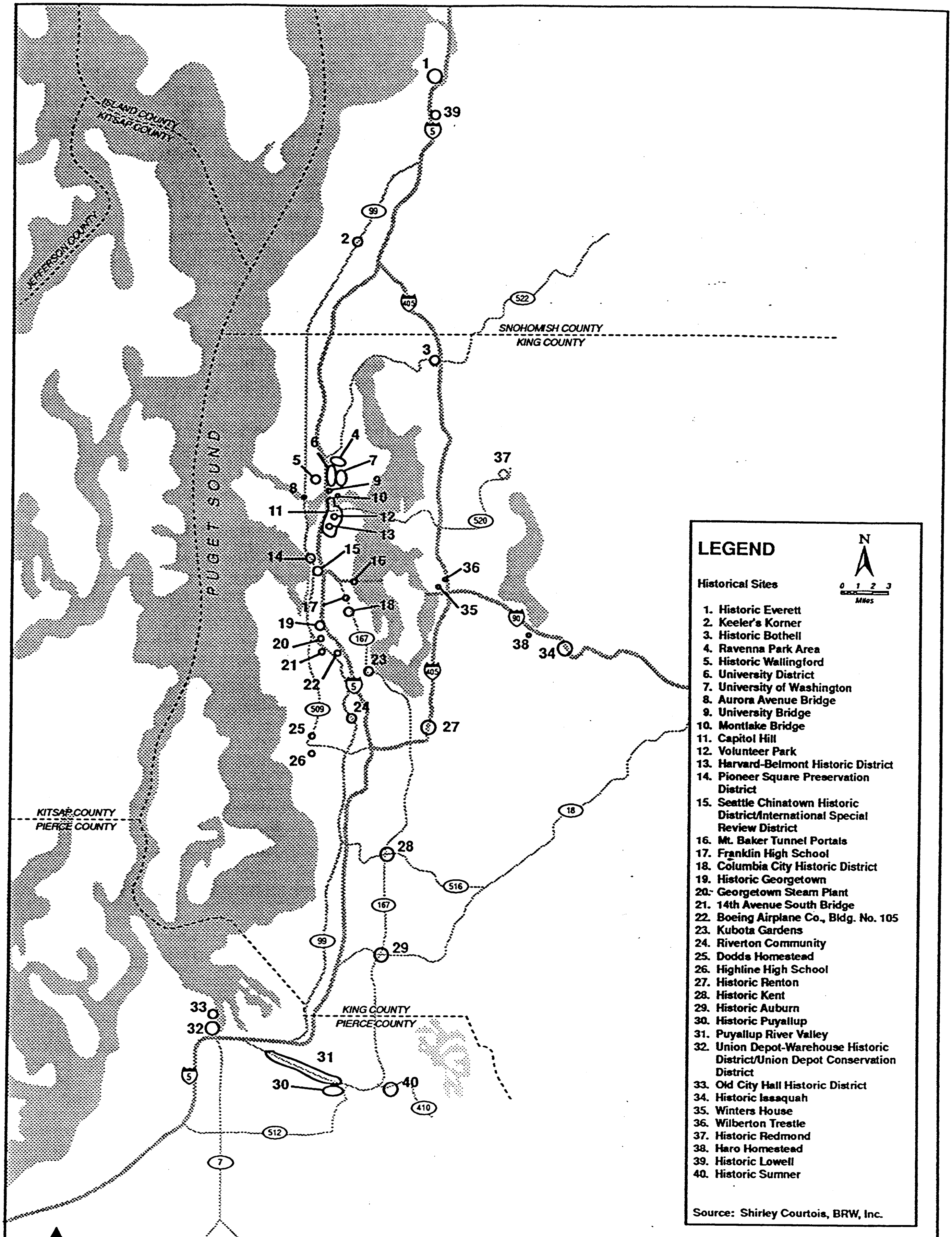
Section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. 303) requires that no prudent and feasible alternative exist to any federal action with negative impacts on historic, cultural, and archaeological properties and areas and that all possible planning has been done to minimize harm. Section 106 of the National Preservation Act of 1966 (16 U.S.C. 470f) requires federal agencies to assess impacts on historic properties, including districts, buildings, structures, sites, objects, traditional cultural properties, and archaeological resources. Agencies must consult with the State Historic Preservation Officer and other parties to avoid or mitigate impacts. Agreements to avoid or reduce harm are reviewed by the Advisory Council on Historic Preservation. Sections 4(f) and 106 apply to properties listed or eligible for listing in the National Register of Historic Places. Section 4(f) also applies to significant properties under state and local preservation laws.

The protection process begins with identification of properties. Often, comprehensive surveys of planning areas result in inventories of potentially eligible properties. If resources meet established criteria, they are entered on official lists and become subject to specific conditions or controls.

The National Register of Historic Places is the official federal list of historic properties worthy of preservation because of their significance in American history, architecture, archaeology, engineering, and culture. Two types of properties that are increasingly being recognized as significant are cultural landscapes and traditional cultural properties. Cultural landscapes are defined areas within which elements of the landscape (such as buildings, vegetation, transportation networks, land use patterns, etc.) show the progression of human habitation over time. The significance of traditional cultural properties derives from their role in the traditional and continuing folkways of a community.

The State Register of Historic Places is the official list of historical properties in Washington State and includes all Washington properties in the National Register. The Office of Archaeology and Historic Preservation (OAHP) in Olympia administers the state, National Register, and other preservation programs. The State Historic Preservation Officer (SHPO) determines the eligibility of properties for inclusion in the National Register, participates in consultations regarding adverse effects to such properties, and agrees to mitigating measures.

Local jurisdictions also administer preservation programs through landmark commissions. These local programs conduct surveys, compile inventories, designate landmark properties, and review actions that affect historic and cultural resources. Local landmarks or properties listed in local registers become subject to local preservation ordinances. Local ordinances generally require that actions affecting designated properties be reviewed by the local preservation commission or board, which may withhold or condition its



Regional Transit Project

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RTPF0204M

Regional Areas of Historical Significance Potentially Affected by System Plan Alternatives

System Plan EIS

FIGURE 3.26

approval. Compliance is mandatory in some jurisdictions and voluntary in others.

The King County Landmarks Commission designates King County landmarks, significant resources protected by regulation, and Community Landmarks, honorary resources with no regulation. The Urban Conservation Division administers Seattle's complex preservation program, including four districts with their own review boards and the Landmarks Preservation Board, which oversees three additional districts and over 200 individual landmarks. The Bothell Landmark Preservation Board approves any changes to properties entered in Bothell's Register of Historic Places.

The Pierce County Landmarks Commission reviews proposed alterations or demolitions of designated properties and may recommend modifications of proposals. The City of Tacoma Landmarks Preservation Commission maintains the Tacoma Register of Historic Places and reviews changes to individually registered properties or properties within three special districts.

At present, Snohomish County does not have an active preservation program, although there is an inventory of potential historic properties. Snohomish County does contain National and State Register resources. Listing in the Everett Register of Historic Places is considered honorary and compliance with Everett Historical Commission recommendations is voluntary.

3.13.2 Impacts of Alternatives

Impacts to historic properties might occur along any proposed alignment, especially in areas with high concentrations of historic and cultural resources. Isolated properties near alignments also face risks. Generally, preservation programs and regulations seek to maintain the integrity of the characteristics that qualify a property for historic status. Adverse impacts may include diminishing the integrity of a property's location, design, setting, materials, quality, feeling, or association. Unknown archaeological resources and traditional cultural properties may be disrupted during construction. In that event, construction will be suspended until appropriate mitigation decisions are made.

3.13.2.1 Construction Impacts

Potential adverse impacts to a property include, but are not limited to:

- Physical destruction, damage, or alteration
- Isolation from historic setting or changing the setting's character
- Restriction of access
- Out-of-character visual, audible, or atmospheric elements
- Deterioration of property or setting through settlement, erosion, etc.

No-Build Alternative

The No-Build Alternative would have no adverse impact on identified or potential historic resources. Improvements would be subject to site-specific environmental review.

TSM Alternative

New or expanded park-and-ride lots, HOV lanes, or other improvements might intrude into historic districts or disturb the setting of individual resources. For example, HOV lanes on SR-99 could affect Keeler's Korner in Lynnwood, a National Register property.

Transitway/TSM Alternative

No impact on historic properties is expected where the transitway is within existing freeway rights-of-way. Construction of the South Corridor busway along Burlington Northern tracks could affect historic resources such as the Rainier Cold Storage & Ice/Seattle Brewing & Malting Company building (City of Seattle Landmark) and Georgetown City Hall (National Register and City of Seattle Landmark). New access ramps and stations might also affect nearby historic properties.

Rail/TSM Alternative

The Rail/TSM Alternative could have potentially significant impacts on historic resources, particularly from tunneling or laying new tracks. A particularly critical area is on Capitol Hill in Seattle, where several National Register and City Landmark properties and two historic districts are located. The University District contains several recognized historic properties as well as the University of Washington campus. South of downtown Seattle, construction could affect the Columbia City Historic District; properties in Georgetown; Boeing Company Building No. 105; several small historic communities; and archaeological sites near the Duwamish River.

Construction of north, south and east terminals could affect centrally located historic and conservation districts in Tacoma, individual historic properties in downtown Everett, and historic areas in Issaquah. The Winters House on Bellevue Way and the Willberton Trestle, both in Bellevue, may also be affected.

<u>Commuter Rail Element</u>. There are historic resources at King Street Station and in downtown Kent and Auburn. However, it would not be essential to disturb or adversely affect any historic property to construct commuter rail. Joint development associated with the project could be used to enhance some historic properties.

3.13.2.2 Operations Impacts

Impacts to historic or cultural properties are defined as those that cause:

- Isolation from or alteration of historic setting
- Restriction of access to historic properties
- Economic deterioration of commercial districts or the deterioration of livability of residential districts through traffic pattern changes
- Out-of-character visual, audible or atmospheric elements
- Deterioration of property or setting through vibration, erosion, etc.

Commuter Rail

Commuter rail operations could be adjacent to historic properties, historic districts, or archaeological sites in downtown Seattle, the Green River

Valley, and the Puyallup River Valley. Increased vehicular traffic and train movements could adversely affect the Pioneer Square historic district. The commuter rail service could also spark rehabilitation of nearby historic properties.

3.13.3 Mitigation of Impacts

Specific mitigation measures will depend on specific impacts to identified resources determined during project-level planning. They could include:

- Locate facilities to avoid historic property destruction or alteration
- Provide landscape elements to lessen noise and visual impacts
- Assure design compatibility of facilities near historic districts or resources
- Monitor construction to identify and mitigate unforeseen adverse impacts
- Relocate historic properties if necessary
- Make an appropriate record of historic properties if no alternative to demolition exists.

4.0 Consistency with Regional Land Use Plans, Policies, and Legislation

The System Plan proposes improvements in three counties, more than thirty municipalities, and within the land use jurisdiction of one Indian tribe. Most local governments have comprehensive plans and zoning ordinances with land use goals and policies. While there are currently no uniform provisions for regional transportation, except in Snohomish County and its local municipalities, all jurisdictions are in the process of updating their comprehensive plans to comply with GMA requirements and countywide planning policies. Regional planning cooperation is being coordinated by the State Department of Community Development and PSRC. SNO-TRAN has assisted local jurisdictions in Snohomish County in planning station areas and preserving rights-of-way.

Government agencies are also in the process of developing plans and ordinances that comply with the State Commute Trip Reduction Law of 1991. Ordinances adopted by counties and cities must be coordinated with transit agencies, regional planning organizations, and major employers and must be consistent with commute trip reduction plans of neighboring jurisdictions. Plans and ordinances are largely targeted for adoption by early 1993. Consistency of RTP alternatives with commute trip reduction is discussed in Section 3.9.3.

Table 4.1 indicates the general consistency of the RTP alternatives with growth management, Vision 2020, and separate countywide planning policies adopted by King, Pierce, and Snohomish counties. For more specific discussion, see the appropriate sections below.

4.1 Growth Management Act

In 1990, the Washington State Legislature adopted the state's first comprehensive growth management act (GMA) to manage growth in the state's fastest growing counties and the cities within these counties' boundaries. The principal tools for implementing growth management are comprehensive plans which are to be adopted by these counties and cities by July 1, 1993. The act established thirteen goals to guide local governments in developing these plans. These goals include several that are of particular interest to the RTP analysis.

- encouraging growth in urban areas
- reducing sprawl
- encouraging efficient multimodal transportation
- encouraging economic development consistent with comprehensive plans
- retaining open space and the developing recreational opportunities
- protecting the environment and enhancing the area's quality of life
- encouraging citizen involvement in the planning process

- o concurrency between public facilities and new private development
- o encouraging historic preservation.

Table 4.1. Consistency of Alternatives with Land Use Goals.

GMA and/or Vision 2020	No-Build	TSM	Transitway /TSM	Rail/ TSM
Encouraging growth in urban areas	n	w	m	s
Reducing sprawl	n	w	m	s
Encouraging efficient multimodal transportation	n	m	s	s
Encouraging economic development consistent with comprehensive plans	n	n	m	s
Retaining open space and developing recreating opportunities	w	w	s	s
Protecting environment and enhancing the area's quality of life	w	m	m	m
Encouraging citizen involvement in the planning process	n	s	s	s
Concurrency between public facilities and new private development	n	n	m	s
Encouraging historic preservation	s	m	m	m
Countywide Planning Policies				
King County				
Promotion of contiguous and orderly development and provision of urban services to such development	n	w	m	m
Siting public capital facilities of a countywide or statewide nature	n	w	m	m
Countywide transportation facilities and strategies	w	m	s	s
Joint county and city planning within urban growth areas	n	m	m	s
Countywide economic development and employment	n	w	m	s
Pierce County				
Designation of urban growth areas and distribution of 20-year population forecasts	n	w	m	s
Countywide transportation facilities and strategies	w	m	s	s
Promotion of contiguous and orderly development and provision of urban services to such development	n	w	m	m
Siting of public capital facilities of a countywide or statewide nature	n	w	m	m
Snohomish County				
Urban growth areas and population distribution	n	w	m	s
Transportation facilities and strategies	w	m	s	s
Contiguous and orderly development	n	w	m	m
Siting of capital facilities	n	w	m	m

n=nil; w=weak; m=moderate; s=strong

In addition, the comprehensive plans must address land use, capital facilities, utilities, housing, rural lands, and transportation. The transportation element must be consistent with and implement the land use element and identify system improvements and traffic demand management plans to meet projected demand. The plan must also include a process for siting essential public facilities, including regional transportation, facilities. No comprehensive plan or development regulation may preclude siting these facilities. The GMA also sets forth concurrency requirements to "ensure that those public facilities and services necessary to support development shall be

adequate to serve the development at the time ... and enforce ordinances which prohibit development approval if the development causes the level of service on a transportation facility to decline below standards adopted in the transportation element ..." Finally, the Act mandates that the plans' goals, objectives, policies, and strategies be in agreement.

To further guide the preparation of comprehensive plans, the 1991 required the proper jurisdictions to develop multicounty and countywide planning policies. King, Pierce, and Snohomish counties have recently adopted and ratified countywide policies. PSRC is leading an effort to identify and address key issues for multicounty planning, such as regional compliance with GMA, compatibility of countywide plans, and the relationship between countywide policies and Vision 2020.

The GMA has major implications for the RTP. The development of multicounty, countywide, and comprehensive plan policies and plans that focus heavily on transportation issues provides a timely opportunity for transit operators to work with counties and local jurisdictions to include public transportation needs in these policies, plans, and regulations. The transit system that results should strongly support the goals and objectives of the comprehensive plans currently being developed.

These parallel planning processes create a unique opportunity to develop coordinated land use and transportation plans among jurisdictions in the region. The RTP is one step of a process leading to project-specific analyses in 1993 and final project planning beyond that. At each step, the System Plan will be compared to current comprehensive plans and regulations and could be modified, if necessary, to ensure consistency. This will be an interactive process, with comprehensive plan processes also examining their consistency with current RTP plans.

Table 4.1 analyzes the consistency of the RTP alternatives with the nine key GMA goals and key countywide planning policies. As noted above, these goals and policies are intended to guide development of comprehensive plans, not to evaluate actions such as the RTP. Nonetheless, alternatives that are consistent with these goals and policies should be generally consistent with the comprehensive plans that are being developed using these goals and policies. Table 4.1 shows that the RTP alternatives support these goals and policies to varying degrees.

In general, the Rail/TSM Alternative most strongly supports the goals of encouraging growth in proximity to needed public facilities, reducing sprawl, encouraging efficient multimodal transportation, and a number of other goals and policies, because it supports land use plans that promote higher densities in population and employment centers. The Transitway/TSM Alternative moderately supports these goals and policies, because it also promotes higher densities in population and employment centers, although to a lesser degree than the Rail/TSM Alternative. The TSM Alternative is least consistent with these goals and policies, because it does not provide rapid service into centers and would not help direct urban development to appropriate areas as well as the high-capacity alternatives.

4.2 Vision 2020

PSRC's *Vision 2020 Growth Strategy and Transportation Plan (1990)*, which serves as the interim multicounty planning policy document, aims to contain urbanization and focus much of the expected growth into ten to fifteen centers that can be efficiently served by rapid transit. The Plan includes a 130-mile regional rapid transit system, 300 miles of HOV lanes, significant bus fleet expansion, 20,000 additional park-and-ride spaces, and major transportation demand management. Higher-density residential development should be within walking distance of rapid transit stations, ferry terminals, or bus centers.

The Vision 2020 land use plan represents a regional policy decision about future land use patterns in the region. RTP is an important mechanism to achieve that vision. The System Plan process is a means of choosing the transit system that will help make that vision a reality. The transit solutions discussed in this EIS are directed to a large extent by policy choices already made about land use and regional growth.

The following discussion of consistency with Vision 2020 is based on PSRC staff's response letter to the DEIS.

No-Build Alternative

The No-Build Alternative limits capital investments for transit to those necessary for maintaining existing levels of service and would not provide the major transit expansion necessary to support the land use concepts proposed by Vision 2020. In particular, the level and type of transit service proposed under this alternative would not support the concentration of growth in centers, help to contain urban development within growth areas, or improve the competitiveness of transit with the automobile.

TSM Alternative

Completing the HOV system under this alternative would improve mobility to and from major regional centers and encourage some increased concentration of employment and other land uses. Transit system accessibility, however, would be more dispersed and less intensely focused within major regional centers than with a fixed-route rapid transit system. This less focused network of transit access points may limit the ability of this alternative to optimally support compact, high-density growth in centers. In addition, the lack of a more visible investment in transit infrastructure within major regional centers would not likely provide the incentives necessary to attract substantial investment in centers.

Transitway/TSM Alternative

Like the TSM Alternative, increased accessibility and supportive land use plans would encourage some increased concentrations of employment and population growth at centers. However, the exclusive transit right-of-way (or transitways) would provide direct transit access to only a few of the major regional centers, including the downtowns of Seattle, Bellevue, Tukwila, and at Northgate. Most of the remaining regional centers would be served by supporting HOV facilities, as in the TSM Alternative.

Extensive feeder bus services would be oriented to transitway stations within regional centers, providing more focused accessibility and visible evidence of a financial commitment to transit. However, due to the structural characteristics of transitways, stations within centers may have limited potential for promoting high concentrations of growth. Conventional surface or elevated transitways are generally not operationally or aesthetically compatible with dense urban centers. Transitways can require significant amounts of land and can be disruptive to other land uses, limiting the potential to increase residential and employment densities.

Neither the TSM nor the Transitway/TSM Alternative could accommodate the transit demand associated with implementing the Vision 2020 land use concept and, consequently, would not fully support its land use goals.

Rail/TSM Alternative

About 30 percent of the regional population is forecast to be within a 30 minute transit ride of the regional centers (compared to 20 percent for TSM and Transitway/TSM) and 40 minutes would be the average travel time to those centers (compared to 46 minutes for TSM and 45 minutes for Transitway/TSM). Based on a comparison of travel times to and from a selected group of regional centers, the Rail/TSM Alternative would provide travel time savings from three to eight times greater than the TSM or Transitway/TSM Alternative.

Rail transit stations would provide a visible and substantial investment in rapid transit service at most of the candidate regional centers. By the year 2020, rapid rail service would link the downtowns of Everett, Lynnwood, Redmond, Seattle, Renton, Issaquah, Burien, Tukwila, SeaTac, Federal Way, Tacoma, and Bellevue, as well as candidate regional centers at Overlake, Totem Lake, University District, First Hill/Capitol Hill, and Northgate. Commuter rail would link the downtowns of Seattle, Kent, Auburn, and Tacoma. Other regional and manufacturing/industrial centers would be served by high capacity bus service. The increased accessibility to these centers would generate significant market potential for compact, high-density employment, commercial, and residential growth.

Summary

Although a regional transit system would be only one of many transportation and land use planning actions for managing growth, the type and extent of transit investments would have a significant impact on achieving the Vision 2020 objective of concentrating growth within major regional centers. The Rail/TSM Alternative would support the Vision 2020 centers growth strategy better than the No-Build, TSM, or Transitway/TSM alternatives. Under the Rail/TSM Alternative, more candidate regional centers would be served with high quality, high speed transit service and the substantial visible commitment to transit would promote compact, high-density growth within major regional centers (PSRC 1992).

4.3 Countywide Planning Policies

Countywide planning policies to guide comprehensive growth management planning have been adopted by the three counties in the region. Although the System Plan is a regional plan and thus is not subordinate to any individual county plan, it is important that the System Plan be consistent with county plans to the extent possible. RTP is coordinating its regional transit planning with the land use planning taking place in each of the three counties, including modifying its plans as priorities change and become more definite in each county.

4.3.1 King County

The King County Growth Management Policy Committee (GMPC) has developed a template for directing county growth over the next 20 years. Much of the growth would occur in Urban Growth Areas (UGAs), which will accommodate at least the 20-year projection of population and employment growth and provide a full range of urban services. Within the UGAs, King County will identify a number of Urban and Manufacturing/Industrial Centers - areas of concentrated employment and housing which would be served directly by high capacity transit. Growth will first be directed to these centers and urbanized areas with existing infrastructure capacity, second to areas which can easily be provided with services, and last to areas requiring major infrastructure improvements. Urban separators (permanent low density lands) will protect resource lands and create corridors between urban lands.

The following cities have nominated areas to serve as urban centers in King County: Bellevue, Federal Way, Kent, Redmond, Renton, SeaTac, Seattle, and Tukwila. All of these cities are regional centers under Vision 2020 and would be served by the various alternatives, as discussed in Section 4.2. The following cities have also nominated manufacturing/industrial centers: Kent, Seattle, and Tukwila. These manufacturing centers would be served by rapid rail, commuter rail, or high capacity bus service. As noted in Section 4.1, the System Plan will be compared to current comprehensive plans and regulations and could be modified, if necessary, to ensure consistency with the final designation of these centers.

Urban Centers must meet specific criteria for geographic size, number of jobs, and housing densities sufficient to support high capacity transit. Manufacturing/Industrial Centers shall also meet criteria for geographic size, number of jobs, transit, truck access, and parking. Centers will be designated through a joint local-county adoption process.

The policies call for the land use pattern to be supported by a balanced multi-modal transportation system (including high capacity transit, a non-motorized component, and transportation demand management (TDM)) cooperatively planned, financed and constructed by county jurisdictions and others. Vision 2020 provides the framework for creating a system of regional centers linked by high capacity transit and HOV, and the Puget Sound Regional Council's Transportation Improvement Program should be the primary tool for prioritizing improvements. Metro is responsible for establishing transit LOS standards. Each jurisdiction shall identify facilities necessary to coincide with target service levels and timing requirements.

Capital facilities shall be sited to support land use pattern and economic activities while mitigating any negative impacts.

Both the Transitway/TSM and the Rail/TSM Alternative would connect the region's major urban and manufacturing centers with fast, efficient service, while expanded and restructured bus service would bring people from neighborhoods into the centers. The TSM Alternative would provide somewhat less efficient connections. The No-Build Alternative would not be consistent with the county policies.

All three build alternatives include the following called for in the Countywide Policies:

- expanded transit service between residential areas and the centers
- interconnected system of diamond lanes
- facilities for bikes and pedestrians
- programs which support use of transit and ridesharing.

Both the Transitway/TSM and Rail/TSM Alternative provide high capacity transit lines linking major centers. However, the Rail/TSM Alternative provides a much more extensive network than the Transitway/TSM Alternative. Unlike the Rail/TSM Alternative, neither the TSM and Transitway/TSM alternatives provide the level of transportation capacity in already congested corridors and centers necessary to accommodate projected transit demand.

Under all three build alternatives, the system would be implemented incrementally to serve both immediate and long term needs. Transit levels of service will be established in coordination with counties and local jurisdictions to help planners anticipate levels of transit service in their communities. Bus service would be expanded and restructured. Along with phased rail system development, this would allow the transit system to support local land use actions and help shape new growth patterns.

The capital improvements associated with the three build alternatives would be sited to support the preferred land use pattern and proceed in accordance with the process established by the GMPC. The Rail/TSM Alternative would involve the most extensive siting and development process of the three build alternatives while providing a high level of investment in a number of centers (see also Table 4.1).

4.3.2 Pierce County

Pierce County has adopted county-wide planning policies in accordance with the 1991 GMA amendment. Urban Growth Areas (UGAs), accommodating 20 years' growth, are to be determined through a synthesis of city-designated municipal UGAs and county-designated county UGAs. The UGAs' size and boundaries will be based on preserving resource/environmentally sensitive lands and open spaces, new fully contained communities (FCCs) consistent with the centers concept of Vision 2020, adequate provision of services, sufficient supply of developable land, existing projects and development, land features, availability of public services and facilities, and jurisdictional boundaries and designations. The county and cities will also coordinate LOS designations for the transportation system, understanding that such

determinations will affect growth. The county and cities will monitor the adequacy of the system and address deficiencies by prioritizing improvements for funding, using TDM and/or TSM. Compatibility between land use and transportation will be achieved through requiring 20-year phasing of transportation improvements, restricting improvements outside of UGAs, and using land use regulations to improve modal split. The county and cities will address the environmental impact of policies and energy conservation and encourage efficient use of the transportation system through structural and non-structural improvements.

The Regional Transit Plan build alternatives support the policies by:

- connecting centers with transit
- connecting residential areas with centers with expanded transit service
- investing in facilities for pedestrians and bicycles
- promoting the completion of the HOV lanes
- promoting programs that reduce travel demand and encourage people to use transit and ridesharing.

As shown in Table 4.1, the Rail/TSM Alternative would most strongly support growth management planning in Pierce County by best directing urban growth and promoting contiguous and orderly development. The Transitway/TSM Alternative would also provide some support to these objectives. The TSM Alternative would be the weakest of the three build alternatives in promoting land use goals.

4.3.3 Snohomish County

Snohomish County's adopted Countywide Planning Policies include a range of policies intended to ensure consistency among the county and comprehensive plans, as well as consistency with GMA provisions and the regional Vision 2020 plan. Snohomish County plans to establish urban growth areas (UGAs) by October, 1993 that accommodate at least the 20 year population growth projection,. UGAs are based on plans for preserving existing development and infill strategies, can be supported by urban services, do not infringe on resource lands, and include designated open space within UGA boundaries and on the periphery to provide separation. Snohomish County would allocate final growth projections through a cooperative planning process with the Snohomish County Tomorrow (SCT) Steering Committee, a group of elected officials from the county, cities, towns, and the Tulalip Tribe. Centers within the UGAs will be established according to a hierarchy consistent with Vision 2020 and which reinforces efficient transportation and infrastructure planning. These centers would have clearly defined geographic boundaries. Growth would be accommodated first in larger centers where higher density residential and employment concentrations will be encouraged. Areas within urban growth boundaries which are designated for multi-family and non-residential development will be characterized by mixed use, pedestrian friendly and transit compatible development. Urban center designations would be coordinated with appropriate transit planning agencies. Although not officially designated at this time, Metropolitan and Subregional Centers would be located along planned rapid transit routes.

An approved countywide transportation plan will establish the basic framework for city and county transportation plans. Core transportation goals include development of a multi-modal system, reduced reliance on single-occupancy vehicles, and increased availability and use of high occupancy vehicles and lanes. Draft policies for transportation include provision of public transportation services appropriate to designated types and intensities of land use, use of TDM to reduce trip making, and development of uniform criteria for locating and mitigating the impact of major county-wide and regional transportation facilities and services, including high capacity transit facilities.

The build alternatives, particularly the Rail/TSM Alternative, are consistent with the framework policies in terms of goals and objectives. The Snohomish County policies support the Vision 2020 goals, which call for maintaining regional mobility via creation of a comprehensive multi-modal system consisting of rapid transit, expanded transit service, completion of the HOV system, and reduced reliance on single-occupancy vehicles. Concentration of growth in designated mixed use regional centers served by rapid transit would best be served in Snohomish County by the Rail/TSM Alternative, and to a lesser extent by the Transitway/TSM and TSM Alternative, in that order (see Table 4.1).

4.4 Local Plans

Capital projects proposed by the System Plan would affect local jurisdictions throughout the region. The consistency of the project with local plans varies, although most plans call for improvements in transit service. Plans adopted before the system planning effort make little reference to rapid transit within their jurisdictions or endorse transit-supportive land use policies. Most plans are currently being rewritten because of growth management requirements (see Technical Appendix C). For this reason, while a detailed assessment of consistency with adopted local plans was done and can be found in Technical Appendix C, the assessment was not included in the text of the EIS, due to the recognition that most of these plans will change in the next few months. RTP is coordinating its plans with the growth management planning taking place at the local level to ensure as much as possible that its regional planning takes into account local land use priorities and that local plans reflect to the extent possible the regional transit planning that is taking place.

4.4.1 Changes Needed to Local Plans

4.4.1.1 No-Build Alternative

Because it involves no major transit actions, this alternative would not require changes to local plans.

4.4.1.2 TSM Alternative

HOV priorities and lanes, park-and-ride lots, and transit promotion might be formally adopted in local plans and codes. Development regulations could reinforce travel demand management (TDM) provisions, encourage transit ridership, carpooling, and bicycling, and discourage SOV use by limiting parking supply and increasing parking costs. It is important to ensure that

safe and convenient connections can be made by bicyclists and pedestrians to park-and-ride lots. Design guidelines can require that these facilities provide protection from weather, secure places to store bicycles, and safe places to cross streets and travel through parking lots to create an environment that encourages more pedestrian and bicycle access to transit services.

4.4.1.3 Transitway/TSM Alternative

In addition to changes identified for the TSM Alternative, the transitway alignment will require identification and designation in local transportation plans. Land use controls along the alignment may need to be enacted. Station areas, particularly key transfer points and park-and-ride locations, may need special designation. The existing land uses and development density could either be protected and preserved or changes could be directed for redevelopment and intensification. Again, pedestrian and bicycle access can be encouraged and enhanced by means of design guidelines requiring the provision of safe and convenient access to transit facilities.

4.4.1.4 Rail/TSM Alternative

In addition to changes identified for the TSM Alternative, the rail corridors and station areas should be recognized in local plans and zoning. Provisions such as overlay districts would protect existing land use patterns or direct redevelopment and intensification. Plan, policy and regulatory responses would be needed to preserve right-of-way and control land speculation. The adoption and implementation of transit-friendly plans and policies by jurisdictions will be an important consideration in phasing the development of the Rail/TSM Alternative.

The Rail/TSM Alternative requires considering increases in density and mixed use development. Combining housing and employment at greater densities near stations will require policy and zoning changes and possible upgrades of public infrastructure. Tighter controls will be necessary to discourage rural or suburban development.

Commuter Rail Element. Like other rail stations, commuter rail stations will need to be recognized in local plans and zoning ordinances to fully realize development potential.

5.0 Summary of Comments on the Draft EIS

5.1 Summary of Comments

SEPA rules allow a summary of the comments on the draft EIS to be appended to the final EIS when there are a large number of comments and when many of the comments are repetitive. The rules also require that the names of all commenters be listed in the FEIS. The full text of all of the comments received and staff responses to those comments are contained in two supplemental volumes, which are available upon request from Metro (see Fact Sheet).

As noted elsewhere, Metro, as lead agency, responded to the comments by modifying, supplementing or improving the analyses contained in the DEIS and by making factual corrections. Many comments expressed preferences among the alternatives rather than seeking changes in the environmental analysis. Those comments were acknowledged but generally did not warrant further response by Metro. The two-volume Comment and Response documents have been forwarded to the decisionmakers on the Joint Regional Policy Committee for their consideration, and they are publically available at libraries throughout the three-county area (see Distribution List). The Comment and Response documents are hereby incorporated into the FEIS by reference.

Over 2,000 specific comments were made in verbal testimony and in writing. This summary is meant to be representative of the comments received, but is not meant to be inclusive of all comments received. Readers are asked to refer to the Response and Comment document for an inclusive listing and discussion of comments.

5.1.1 Elements of the Environment

5.1.1.1 Earth

Commenters requested an expanded discussion of the potential impacts of a newly discovered earthquake fault in the central Puget Sound area on the various build alternatives. Concern was expressed on how subway and aerial alignments would withstand the impacts of a major earthquake along the "Seattle fault."

5.1.1.2 Air Quality

Commenters questioned the limited beneficial impacts of the build alternatives on air quality. There were questions on the assumptions used in determining existing air pollutants caused by diesel buses and specific requests for including deadhead miles in bus air pollutant calculations. Commenters were concerned about the adverse impacts of park-and-ride lots on local air quality. Commenters wanted additional information on how

current and future air quality legislation would affect bus and general vehicle fleet emissions. Commenters wanted consideration of the benefits of electric cars and other low-polluting vehicles. Commenters also requested information on pollution caused by electrical generation facilities in the case of expanded trolley fleets and electric rail systems.

5.1.1.3 Noise and Vibration

Commenters wanted additional information about noise levels of aerial rail structures, especially along Roosevelt Way between I-5 and Aurora Avenue North.

5.1.1.4 Water Quality and Hydrology

Commenters requested additional information on floodplain regulations and the dewatering related to tunnel construction.

5.1.1.5 Ecosystems

Commenters requested clarification on what wetland mitigation measures would be taken if takings of wetland areas were unavoidable.

5.1.1.6 Energy

Commenters questioned the assumptions used in determining existing and future transit fleet energy consumption figures. Specific requests were made for including deadhead miles in energy calculations. Commenters also requested information on energy efficiency of future bus fleets.

5.1.1.7 Environmental Health

Commenters suggested several additions to the list of identified potentially significant hazardous waste sites. Commenters asked for more up-to-date information on the health effects of electromagnetic fields (EMFs).

5.1.1.8 Visual Quality

Commenters expressed concern relative to the visual impacts of aerial structures.

5.1.1.9 Transportation

Commenters expressed concern about the relatively limited impact of the build alternatives on regional VMT. Commenters requested additional information on traffic impacts in the vicinity of new park-and-ride lots and proposed rail stations, including more detailed mitigation measures. Commenters requested information on the assumptions used in modeling ridership and mode split. Commenters requested additional information on bicycle access to transit. Commenters requested additional detail concerning the impact of Vision 2020 and the Commuter Trip Reduction Act on potential transit ridership. Commenters requested additional information on the accessibility of the transit system for the elderly and disabled. Commenters requested information on the impacts of commuter rail service on freight railroad operations.

5.1.1.10 Land Use and Economics

Commenters requested additional information on the relationship between the Regional Transit Project and Vision 2020, the Growth Management Act, and local comprehensive plans. Commenters requested additional information on employment growth in the region. Commenters requested additional consideration of affordable housing and real estate costs. Commenters requested information on the amount of solid waste generated in the demolition and construction activities and on disposal plans related to such wastes. Commenters expressed concern about the impacts of the build alternatives on urban sprawl and densities.

5.1.1.11 Parks and Recreation

Commenters requested clarification on potential impacts on park and recreation facilities.

5.1.1.12 Historic and Cultural Resources

Commenters requested information on historical and cultural resources related to the commuter rail element.

5.1.2 Other Topics

5.1.2.1 Alternatives

Commenters requested additional clarification of the No-Build Alternative. Commenters requested consideration of rapid rail and/or commuter rail to Renton, Southcenter (Tukwila), Lakewood, Ft. Lewis/McCord, and commuter rail to Everett. Commenters requested consideration of commuter rail on all available freight tracks in the region. Commenters proposed changes in the TSM and Transitway/TSM alternatives. Commenters requested consideration of a larger Transitway/TSM alternative.

Commenters requested more detailed consideration of surface light rail options (such as the Rhododendron Line proposal). Commenters requested consideration of cross-lake ferries, congestion pricing, and rail service to Olympia.

5.1.2.2 Miscellaneous

A sample of other comments received on the DEIS and draft System Plan includes:

Commenters requested information on the relationship of the RTP to the state's high speed rail plan. Commenters requested an expanded discussion of transportation demand management techniques and the Commute Trip Reduction Act.

Commenters requested that the EIS include a discussion of the fiscal impacts of the alternatives. Commenters questioned the financing plan and the methodology used in determining capital and operating costs. Commenters voiced a range of opinions on the appropriate tax mix for financing the proposed system.

Commenters requested consideration of lifestyle changes required to meet project goals. Other commenters advocated changes in lifestyle to surpass ridership goals.

Commenters requested information on the relationship of the current environmental process to NEPA. Commenters requested information on the schedule and methodology to be employed during project-level environmental review.

Commenters questioned the use of tunnels in the rail alternative. Commenters both advocated additional HOV lanes and requested no RTP involvement in additional HOV lanes.

Commenters expressed a multitude of opinions relative to the Rail/TSM Alternative, ranging from full support to complete opposition. Commenters expressed a range of opinions on phasing, length of construction, connections with other modes of public transportation (ferries, intercity buses, airports), total construction costs, and conversion of regular freeway lanes for HOV use, among other topics.

This summary is meant to be representative of the comments received, but is not meant to be inclusive of all comments received. Readers are asked to refer to the Response and Comment document for an inclusive listing and discussion of comments.

5.2 LIST OF COMMENTERS

GOVERNMENT AGENCIES

Washington State
- Department of Community Development
- Department of Ecology
- Department of Transportation
- Senate
- University of Washington
- HCT Expert Review Panel

Regional
- Puget Sound Air Pollution Control Authority
- Puget Sound Regional Council

County
- King County
- Eastside Transportation Program
- Port of Seattle
- Pierce County
- Snohomish County
- Snohomish County Committee on HCT
- Snohomish County PUD #1

LIST OF COMMENTERS
GOVERNMENT AGENCIES (Cont.)

Local

City of Auburn
City of Bellevue
City of Bothell
City of Edmonds
City of Everett
City of Everett Public Works
Everett School District No. 2
City of Federal Way
City of Kirkland
City of Lynnwood
City of Mountlake Terrace
City of Mukilteo
City of Renton
Seattle City Light
City of Seattle Planning Commission
City of Seattle
City of Sumner
City of Tacoma Planning
City of Tacoma Environmental Commission
City of Tukwila

INTEREST GROUPS

Bellevue Downtown Association
Citizen's Transit Advisory Committee
Eastside Transportation Committee
EDC of Seattle and King County
EDC of Snohomish County.
Everett Area Chamber of Commerce
For Everett
Greater Renton Chamber of Commerce
Greater Seattle Chamber of Commerce
Intercity Transit
Leagues of Women Voters of King Co.
Municipal League
North Renton/Kennydale Neighbohood
Puget Power
Puget Sound Light Rail Transit Society
Queen Anne/Magnolia Noise Abatement Group
Rainier Beach Commuity Club
Seattle Community Council Federation
Seattle Economic Development Council
Seattle/King Association of Realtors
Sierra Club
Southeast Effective Development, Inc.(SEED)
Snohomish CCIT
SW King County Chamber of Commerce
Tacoma League of Women Voters
Washington Environmental Council
Washington Natural Gas
Washington Society.of Professional Engineers
Washington Transportation Policy Institute

LIST OF COMMENTERS
INTEREST GROUPS (Cont.)

Bernard Development Company
The Burke Associates
Pathfinder Systems, Inc.
Reed
TDA
M2

INDIVIDUALS

Anonymous
Acheson, Duane
Adams, John
Albright, Berny
Anderson, Stephen
Avolio, Joseph, Jr
Baker, Roger
Berg, Dell
Bocksh
Bohn, William
Bollom, Michael
Bray, Daniel
Brooks, R./Crockett, C.
Brown, Christopher
Brown, Patricia
Browne, Bob
Burke, Herbert
Burt, Robert
Carter, Pamela
Coburn, Jason
Cooper, Hal
Cornish, Charlie
Crisman, Gerald
Crockett, Carolyn
Darraugh, Jack
Dillner, Eva
Elsaesser, Wayne
Engel, John
Eno, Kraig
Foster, Stacey
Foxworthy, Robert
Frank, Indra, MD
Gemberling, Ted
Ginn, John
Gurley, Worth
Haigh, John
Harkness,Richard
Hartmann, David
Hartmann, Raymond
Hemerick, Glen
Henry, Howard
Henry, Robert
Hensley, Particia
Herman, John
Hill, Gregory
Hom, Wayne
Jackowich, Douglas/Shaughnessy, Steven
Johnson, Donald
Kennedy, Richard
Knodell, John
Kronmann, Ken
Kuehne, Lauren
Larkin, Amy
Long, Sara
Mailey, Patrick
Mandel, Eric
Maye, Velva
McIntosh, James
Menchhofer, Dale
Moritz, William
Morrill, Richard
Myewurds, Marc
Nelson, Dick
Nichols, Ralph
Nitardy, John
Nothaft, Walter
Oveson, Odd
Padelford, Donald
Partridge, Mike
Peterson, Keith
Pope, Jemae
Price, Oleg
Reed, R.C.
Richardson, James
Ruskie, Howard
Sanger, Eldine
Schack, Steve
Scheerer, M.C.
Schott, Carolyn
Schuh, Michael
Silva, Jeanette
Skehan, Michael
Smith, Diana
Smith, James
Smith, Peter
Sterling, Jeffrey
Storer, Robert
Storz, John
Stuart, Malcom
Sumner, Larry

LIST OF COMMENTERS
INDIVIDUALS (Cont.)

Tanner, Jesse
Taraday, Jeffery
Vaa, Robert
Vaupel, Warren
Wagner, Peter
Waite, Viola
Whalen, Robert
White, Bob
White, Kathryn
Wieckowicz, Donald
Wilson, Cynthia
Winge, Doug
Yee, Warren
Zepeda, Barbara
Zink, David

COMMENT SHEETS

1 - 42	Anonymous
43	Albrecht, Michael
44	Barbero, Roy
45	Barrett, Rick
46	Beachy, Susan
47	Boushey, Betty
48	Briggs, Geoff
49	Brown, Don
50	Browne, Bob
51	Cady, Charles
52	Coleman, Jean
53	Custodio, Desiree
54	Dalby, Graig
55	Dawson, Jo
56	Deeter, John
57	Douglas, Allen
58	Eades, B.
59	Eberhart, Chuck
60	Eckmann, Eleanor
61	Edwards, Wes
62	Ellis, Becky
63	Evans, Jack
64	Flem, Lloyd
65	Fredin, Jerri
66	Garrou, Christy
67	Hutchinson, John
68	Ha, Cuong
69	Hadaller, Oren
70	Hall Crain, Warren
71	Hauge, Ellen
72	Hawkins, Liz
73	Heggen, Stanley
74	Hemke, Harold
75	Hobbs, Michael
76	Huckaby, Michael
77	Jackson, Mamie
78	Johnson, Barbara
79	Keever, Robert
80	Klinker, Cheryl
81	Knudson, Robert E.
82	Knudson, Sybil
83	Koval, Sheryl
84	Larsen, Bob
85	Leask, Jan
86	Leslie, Michelle
87	Limbaugh, Sherman
88	Link, Tom
89	Lisaius, Fred
90	Lund, Ray
91	Marshall, David
92	Marx, Nancy
93	McCormack, Cecil
94	Myers, Hank
95	Nothaft, Walter
96	O'Neal, Anne
97	Oaksen, Greg
98	Ostrom, Aaron
99	Owens, James
100	Pace, Tony
101	Pawlowski, E. J.
102	Peterson, Drew
103	Petrie, David
104	Phelps, Richard
105	Pollack, Irwin
106	Redding, Judy
107	Ross, Anita
108	Roth, Catherine
109	Sheldon,Jerome
110	Smith, H.
111	Spaulding, Hester
112	Stankevich, Barry
113	Straight-Wright, Zee
114	Strannigan, G.
115	Thomson, Eric
116	Vaa, Robert
117	Van Hout, Paul
118	Zilmer, Rosemary

LIST OF COMMENTERS

PUBLIC HEARING TESTIMONY

NORTHGATE

Einar Svensson
Craig Chedsey
Barry Whittle
Rick Barret
Jay Bakst
Gorden Cambell
Peter Van Zant
Molly Blades
Frank Hutchins
Loren Siebert
Ron Pierce
Bob LeFeber
Beverly Stanton
Walter Wilke
Fred La Croix
Mike Ruby
Jeffery Sterling
Chris Hawkins
Dave Paeth

AUBURN

Donald Villeneuve
Edward Pawloski
Bob Whalen
Paul Nelson
Michael Skehan
Bill Morchin
Terry Hissong
Bruce McTavish
Robert Keever
Michael Bocatch
Gerald Malcom
Teresa Gilbert
John Keefer

EDMONDS

Al O'Brien
Helmut Etzel
Larry Sumner
Bob Eastman
Cecil McCormack
Annette Berget
Alan Marks
Ken Session
Darrell Ash
Cindy Torgesen
Tom Graff
Frank Hutchins
David Peckarsky
William Milkey
Pat McMahan
Mark Beals
Doug Hannafious
Edsel Hammond
Chuck Hopper

SEATTLE UNIVERSITY

Nym Park
Robert Lazo
Dale Menchhofer
Warren Yee
Kathy Becker
Tony McMahon
Scott Haakon
Bill Clifford
Jean Colman
Rich Lang
Barbara Weismann
John Christy
Christopher Brown
Curtis Knopf
Michael Purman
Joel Taunton
Paul Spitzer
Anita Ross

PUBLIC HEARING TESTIMONY Cont.

BELLEVUE

Day Session	Evening Session
Hans Jensen	Larry Shannon
Rubin Yu	Rich Harkness
Chuck Myrick	Kim Ohlmann
Jerome Baer	Kate Bradley
John Knodell	Gene Pollard
David Petrie	Bradley Hofer
Chuck Quist	Robert Whitbeck
Frank Ordway	
Rick Linville	
Herb McClees	
John Seebeth	
Ward Truess	
Dean Tibbott	
Bobbie May	

SEATAC	REDMOND
Mayor Rants	Nancy McCormack
Oren Hadaller	Martin Sangster
James Waters	Robert Shindler
Denny Lensegrav	Tim Ohlmann
Alan Andersen	Hank Myers
Michael Lough	Reiner Decker
Dana Lough	Bruce Playford
Calvin Castle	Glen Eades
Mark Groening	Jim Stoltefus
Frank Carson	Doug Murray
Ron Chaput	Hal Cooper
Brian Epperson	Anthony Reumundi
Dorothy Waltz	Scott Hudson
	Gifford Jones
	Darlene Sobieck
	Glen Ferguson
	Michael Hoff
	Jim Turner
	Holk
	Jim Reed

LIST OF COMMENTERS

PUBLIC HEARING TESTIMONY Cont.

SEATTLE

Day Session

Ian Morrison
Helen Christopherson
Bill Carey
Warren Crain
Tom Donahue
H.B. Pemberton
Jack Buchans
Greg Oakson
Paul Locke
Jack Shivlock
Charles Boon
Tony MacMahon
Rick Linville
Glenn Chinn
Jill King
Ken Slusher
Sean Cosgrove
Christy Garrou
Daniel Rudie
Barry Whittle
Douglas Todhey
Dave Loutzenheider
David Marshall
Suzanne Pardee
Don Maclaren
Jack Ferguson
Gregory Herz
Frank Ordvay
Jeff Taraday
Charles Vulliet
Mamie Jackson
Aaron Ostrum
Tom Arden

Evening Session

John Ginn
Robert Pincus
Gregory Hill
James McIntosh
Leroy Chadwick
Greg Hough
Steve Klein
Mike Bollom
Art Pederson
Tom Tocher
Thor Thompson
Barbara Zepeda
Adam Fast
Mark Ford
Harry Hull
Mimi Holt
Preston Schiller
Erin Laine
John Guichard
Ryan Hileman
Peter Ways
Jeffrey Sterling

LIST OF COMMENTERS

PUBLIC HEARING TESTIMONY Cont.

FEDERAL WAY

Jim Smith
Mark Freitas
Larry Corkins
Marvin Klopstad
Richard Yasger
Bob Nichols
Mike Skehan
David MacDonanld
Robert Whalen
Klifton Belle
Dave Clarke
Loren Herrigstad
Mike Lanier
Mark Ford
M.C. Sheerer
Petrie
Lloyd Flem
Del Berg
Keith Ono
Bob Griebenow
Jack Mowreader
Gorden Voiles
Nancy O'Brien
Roger Pence

EVERETT

Rosemarie Green
Tony Pace
Barry Stankeird
Kim Starling
Michael Henderson
Bob White
Mark Ahlers
Duane Acheson
Marian Krell
Frank Curtis
Lauren Countryman
Will Mongiello
Tom Burns
Clay Kemper
Robert Eastman
Wayne Sewell
David Peckarski
Bob DeNeui
Cheryl Wolff

TECHNICAL APPENDIX A

BASELINE HIGHWAY IMPROVEMENTS

NORTH CORRIDOR 2020 BACKGROUND HIGHWAY NETWORK SIGNIFICANT POST 1990 CAPACITY IMPROVEMENTS

Interstate Projects

I-5 - 196th St SW/SR-524 Interchange. Reconstruct 196th St SW I/C to add movements to and from the south. Includes extensive city street modifications.

I-5 - 164th St SW Interchange. Interchange modifications to add a WB-SB loop ramp.

I-5 - 112th St WS/Stockshow Rd Interchange. Construct half diamond interchange providing access to and from the south.

State Highway Projects

SR-99 - N 148th St to Everett City Limits. Widen from five to seven lanes.

SR-525 - Alderwood Mall Blvd to SR-99. Complete four-lane freeway.

SR-525 - SR-99 to SR-526. Widen to five lanes.

Major Arterial Projects

W Emerson Place - 15th Ave W to 21st Ave W. Widen to four lanes.

NE Northgate Wy - 15th Ave to Lake City Wy NE. Widen to three lanes.

Broad St Throughway. Extension of Broad St via depressed throughway from new Roy St IC to a modified Mercer St IC.

SOUTH CORRIDOR 2020 BACKGROUND HIGHWAY NETWORK SIGNIFICANT POST 1990 CAPACITY IMPROVEMENTS

Interstate Projects

I-5 - SR 161 Interchange. Construct partial interchange providing access to and from the north. Includes CD lane to SR 18.

I-5 - SR-509 Interchange (@ S 210th). Construct partial interchange providing access to and from the south. Includes CD lane to SR-516. Connects the Sea-Tac access at 28th Ave S. Assumed connection to S 200th, S 196, S 192nd Valley connector.

I-405 - SR-516 to Tukwila IC. SB Truck climbing lane.

State Highway Projects

18 - SR-99 to I-5. Construct additional lanes.

18 - SR-181 Interchange. New interchange to incorporate Peasley Canyon Rd traffic.

18 - C St Interchange. Rebuild.

18 - SE 312th Way to SE 296th St. Widen to four lane freeway.

18 - SE 277th Ext. New interchange.

18 - 144th Ave SE/SE 296th to SE 256th St - ICs. Two interchanges/realign Covington Way.

18 - SE 296th St to Hobart Rd. Four lane freeway.

99 - Oxbow Interchange (102nd). Construct interchange.

99 - Duwamish River/First Ave S Bridge. Parallel southbound bridge and approaches providing three lanes in each direction.

161 - Jovita Boulevard to SR-18. Stages construction to five lanes.

167 - I-5 to Auburn. New four-lane freeway construction along N side of Puyallup River from Port of Tacoma IC to Meridian St S.

167 - S 212th Interchange. Widen undercrossing, provide WBLTL.

167 - SW 43rd (S 180th St) Interchange. Add new ramps.

169 - Witte Rd to Cedar Grove Rd. Expand to four through lanes.

169 - Cedar Grove Rd to 196th SE/Jones. Expand to four through lanes.

181 - S 180th St. Grade-separate intersection.

509 - Cloverdale St Interchange Modificaitons. Construct ramps SB to EB and WB to NB.

509 Alternate - E 21st St - East-West Road from I-705 to Milwaukee Way (four lane freeway viaduct). Phase II: Milwaukee to Marine View (four lane freeway).

515 - SE 220 to SE 196th. Widen to five lanes (Benson Highway).

516 - Wax Rd to SR-169. Add two lanes.

900 - Duvall Ave NE to Newport Way. Widen.

Major Arterial Projects

S 356th St - 1st Ave S to Pacific Hwy S. Widen to five lanes. Completed 1990.

S 348th St - 1st Ave S to Pacific Hwy S. Widen to four lanes. Completed 1990.

SW 320th St - 21st Ave SW to 4th Ave SW. Widen to four lanes. Completed 1990.

S 312th St - 1st Ave S to Pacific Hwy S. Widen to four lanes. Completed 1990.

SE 277th St - SR 167 to Green River. Widen to four or five lanes.

SE 277th St - Green River to SR-516 (four lanes).

SE 277th St - Green River to SR 18. New cross valley roadway. (Four lanes).

SE 256th St - 116th Ave SE to 165th Ave SE. Widen to five lanes to SE 132nd, four lanes east.

SE 240th St - 116th Ave SE to 138th Ave SE. Widen to four lanes.

SE 208th St - 116th Ave SE to 132nd Ave SE.

140th/132nd Ave SE - SE 208th St to SE 176th St. Widen to four lanes.

140th Ave/Pl NE - Pipeline Rd to SR-169. Widen to five lanes.

116th Ave SE - SE 192nd St to SE Petrovitski Road. Widen to four lanes.

S 210th/195th/192nd St - I-5/210th St Interchange to 140th Ave SE. Major E-W cross valley four lane arterial. New interchange at I-5 and SR-167.

Petrovitski Carr - Talbot to 108th Ave SE. Widen.

Petrovitski Carr - 140th Ave SE to 151st Ave SE. Widen to four lanes.

SW 27th St - W Valley Hwy/Strander Blvd to SR-167. New/extended roadway with railroad crossing.

Oaksdale Ave SW - SW 28th St to Sunset Blvd (SR-900). New/extended N-S roadway.

SW Spokane St- W Sea Lower Bridge - W Marginal Way to Manning. Lower two lane bridge replacement.

SeaTac Airport South Access Rd (28th Ave S). New four lane road.

EAST CORRIDOR 2020 BACKGROUND HIGHWAY NETWORK SIGNIFICANT POST 1990 CAPACITY IMPROVEMENTS

Interstate Projects

I-90 - Sunset Wy Interchange Modifications.

I-90 - LV Murrow Bridge Replacement. West end of bridge to 60th Ave SE to three eastbound lanes. Part of I-90 completion. 1993-1994.

I-90 - Bush to 23rd Ave S. Construct three eastbound lanes. Part of I-90 completion.

I-90 - 4th Ave S to Bush. Part of I-90 completion. Seattle access.

I-90 - I-90/I-5 SBCD Spring St Ramp. Part of I-90 completion.

I-405 - Bellevue Vicinity Interchange Improvements. Modification of SE 8th St I/C.

I-405 - Northup Interchange, Stage II. Reconstruct ramps.

I-405 - Northup Interchange, Stage III. Reconstruct ramps.

I-405 - Vicinity NE 53rd St to Vicinity NE 70th St. Extend northbound truck climbing lane.

I-405 - NE 160th St Undercrossing. Widen or replace structure and ramps.

I-405 - Bothell/SR-522 to Vicinity Swamp Creek. Widen I-405 to six lanes northbound and southbound.

State Highway Projects.

SR-202 - E Lake Sammamish Pkwy to Sahalee Way. Widen to five lanes.

SR-520 - NE 130th St. New half diamond interchange and EB merge lane between 130th Ave NE and 148th Ave NE.

SR-520 - SR-901 to SR-202. Widen to four lanes.

SR-520 - SR-202/520 Interchange. Construct new interchange.

SR-527 - 228th St SW to 208th St SW in Snohomish County. widen to 4/5 lanes.

Major Arterial Projects

Northup Wy - 124th Ave to 130th Ave NE. Widen to five lanes. Construction completed.

NE 8th St - 121st Ave to 156th Ave NE. Widen to five lanes. Completion mid-1991.

112th Ave NE - SE 8th St to NE 12th St. Widen to five lanes. Completion mid-1991.

NE 10th St - 100th Ave to 112th Ave NE. Construct new arterial. Completion mid-1991.

Richards Rd - SE 26th to SE 32nd St. Widen to 4/5 lanes. Completion mid-1993.

Richards Rd - Lk Hill Conn to SE 26th St. Widen to four lanes. Completion late 1998.

116th Ave NE - NE 12th St to Northup Wy. Widen to five lanes. Completion late 1999.

Bel-Red Rd - NE 21st St to NE 24th St. Add median turn lane. Completion early 2000.

NE 6th St Ext - 112th Ave to 114th Ave NE. New four-lane arterial. Completion early 1992.

Northup Way - 116th Ave NE to NE 24th St. Widen to five lanes. Completion late 1999.

Issaquah-Fall City Rd - E Samm Pkwy to Issaquah-Pine Lake Rd. Four lanes. Completed 1990.

NE 10th/NE 8th. Convert Rdwys to one-way couplets via ext. of NE 10th St over I-405 and intersecting with NE 8th St.

2010 NO-BUILD HOV NETWORK IMPROVEMENTS

WSDOT-HOV PROJECTS UNDER CONSTRUCTION

I-5 - Connecdtion to I-405 - Foster to Tukwila - Open 1991. .8 mile SB HOV lane.

I-5 - Lucille St to Jefferson St - Open 1992. 7.7 Miles NB/SB median HOV lane.

1-5 - Yesler Wy to Mercer St - Open 1991.1.1 miles SB HOV lane.

I-5 - Ravenna Blvd to Express Lanes - Open 1991. .5 mile SB HOV connection.

I-90 - I-5 to I-405 - Open 1993-1996.14 lane miles between S Bellevue Way and I-5, operating as a two-lane reversible HOV facility.

I-90 - Seattle Transit Access - D-2 - completed 1991. 1.8 lane miles I-5 to Airport Way; including an exclusive busway at the western terminus that will feed into Downtown Seattle Tunnel.

E-3 busway - Spokane St to Royal Brougham. Open 1991. 3.4 lane miles NB/SB bus-only lanes.

I-405 - Tukwila I/C to S Renton I/C. Open 1991. 5.9 miles median HOV lane.

WSDOT-HOV PROJECTS PROGRAMMED AND FUNDED

I-5 Boeing Access to Lucille St. Open 1993. 3.2 mile NB HOV lane, median lane. Construction start 1991.

I-5 - SB from Tukwila to SR-516 NB from 272nd to 200th St. Open 1991. 6 miles, widening inside to accommodate an outside HOV lane. Interim solution.

I-90 - EB to I-405 NB and SB. Open 1993. HOV connections to/from I-405.

I-90 - Collector/Distributor WB flyover ramp from SB I-405. Open 1994. HOV WB only AM peak.

I-405 - S-Curves. Open 1994. Realignment of the S-Curves to a low level structure with inside/outside HOV lanes. There is a 2200' transition zone between SR-169 I/C to the Sunset Overpass from inside lanes to the south to outside lanes going north.

I-405 - NE 8th to SR-520 I/C. 2 lane miles outside HOV lanes.

TECHNICAL APPENDIX B

TSM, TRANSITWAY/TSM, RAIL/TSM CAPITAL IMPROVEMENTS

Description	Type of Facility	TSM	Transitway/ TSM	Rail/ TSM
System (King County)				
WSDOT Various Surveillance, Control & Driver Information	Core Funded Freeway HOV	$62.5 million	$62.5 million	$62.5 million
Various WSDOT Funded Park & Ride Lots	Core Funded Freeway HOV	$11 million	$11 million	$11 million
TSM, Trolley Overhead	System Wide Elements	$73 million	$73 million	$73 million
TSM, Pre-Staging Facilities	System Wide Elements	$12 million	$12 million	-
TSM, Computer Systems/ Enhancements, King Co	System Wide Elements	$62.5 million	$62.5 million	$62.5 million
TSM, Transit Flow & Safety, King Co	System Wide Elements	$15 million	$15 million	$15 million
TSM, Passenger Shelters, King Co	System Wide Elements	$9.2 million	$9.2 million	$9.2 million
TSM, Miscellaneous Projects, King Co	System Wide Elements	$45 million	$45 million	$45 million
TSM, Vanpool Vans, King Co	System Wide Elements	1,713	1,713	1,713
ADA Shuttle Vehicles, King Co	System Wide Elements	370	370	370
Bus Fleet 2020, King Co	Buses	2,145	2,149	1,806
M.O.S., Maintenance & Storage Yard	Maintenance Bases	-	-	1
Redmond, Maintenance & Storage Yard	Maintenance Bases	-	-	1
M.O.S., Maintenance & Storage Yard	Maintenance Bases	-	-	1
M.O.S., Kent Des Moines, Maintenance & Storage Yard	Maintenance Bases	-	-	1
TSM, Maintenance Facilities, King Co	Maintenance Bases	2	2	2
TSM, Maintenance Facilities, King Co	Maintenance Bases	1	1	-
Downtown Seattle Modifications	DSTT Modifications	-	-	$42 million
Vehicles, Rail, Phase 2005 (M.O.S.)	Rail Cars	-	-	178
Vehicles, Rail, Phase 2010	Rail Cars	-	-	75
Vehicles, Rail, Phase 2020	Rail Cars	-	-	143
System (Pierce County)				
TSM, Miscellaneous Projects, Pierce Co	System Wide Elements	$5.3 million	$5.3 million	$5.3 million
TSM, Vanpool Vans, Pierce Co	System Wide Elements	704	704	704
TSM, Passenger Shelters, Pierce Co	System Wide Elements	$1.1 million	$1.1 million	$1.1 million
TSM, Transit Flow & Safety, Pierce Co	System Wide Elements	$1.7 million	$1.7 million	$1.7 million
TSM, Computer Systems/Enhancements, Pierce Co	System Wide Elements	$7.4 million	$7.4 million	$7.4 million
ADA Shuttle Vehicles, Pierce Co	System Wide Elements	152	152	152
Bus Fleet 2020, Pierce Co	System Wide Elements	220	220	172

TSM, Maintenance Facilities, Pierce Co	Maintenance Bases	2	2	2
System (Snohomish County)				
TSM, Miscellaneous Projects, Snohomish Co	System Wide Elements	$10.8 million	$10.8 million	$10.8 million
TSM, Vanpool Vans, Snohomish Co	System Wide Elements	725	725	725
TSM, Passenger Shelters, Snohomish Co	System Wide Elements	$2.2 million	$2.2 million	$2.2 million
TSM, Transit Flow & Safety, Snohomish Co	System Wide Elements	$3.6 million	$3.6 million	$3.6 million
TSM, Computer Systems/ Enhancements, Snohomish Co	System Wide Elements	$15 million	$15 million	$15 million
ADA Shuttle Vehicles, Snohomish Co	System Wide Elements	157	157	157
Bus Fleet 2020, Snohomish Co	Buses	500	500	342
TSM, Maintenance Facilities, Snohomish Co	Maintenance Bases	2	2	2
Commuter Rail				
Commuter Rail System	Rail, Guideway	-	-	$195 million
North (King County)				
N 145th Center HOV Access to I-5	Access Improvements	6,000 LF	6,000 LF	-
Northgate Access Ramp to I-5 South	Access Improvements	9,000 LF	9,000 LF	-
I-5 Shoulder Transit Ramp to Olive Way Overpass	Access Improvements	3,000 LF	3,000 LF	-
NE 145th HOV Lane, Meridian to 15th NE	Arterial HOV	9,730 LF	9,730 LF	9,730 LF
SR 99 PK-Only Transit Lane, Winona to N 205th	Arterial HOV	30,720 LF	30,720 LF	30,720 LF
Montlake HOV Lane, NE 45th to Pacific	Arterial HOV	5,632 LF	5,632 LF	5,632 LF
SR 522 HOV Ext., EB HOV, 154th - 80th	Core Funded Freeway HOV	12,144 LF	12,144 LF	12,144 LF
I-5 Shoulder HOV, Olive to SR 520	Core Funded Freeway HOV	10,240 LF	10,240 LF	10,240 LF
145th Street Station Parking	Park & Ride	-	-	800 cars
NE 175th Street Station Parking	Park & Ride	-	-	1,200 cars
68th Av. NE/SR 522 P&R Lot Expansion	Park & Ride	300 cars	300 cars	300 cars
NE 145th/I-5 P&R Lot	Park & Ride	300 cars	300 cars	-
NE 145th/SR 522 P&R Lot Expansion	Park & Ride	400 cars	400 cars	-
Northgate P&R Lot Expansion	Park & Ride	1,000 cars	1,000 cars	1,000 cars
Shoreline Lot P&R Expansion	Park & Ride	400 cars	400 cars	-
N 175th P&R Lot	Park & Ride	400 cars	400 cars	-
Northgate Transitway Station	Passenger Facility	-	$5.3 million	-
Aurora Village Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	$1.7 million
SR 520 Montlake Flyer Stop Improvements	Passenger Facility	$.4 million	$.4 million	$.4 million

SR 522 Priority Treatment, I-5 to NE 145th	Priority Treatment	$7.3 million	$7.3 million	$7.3 million
Northgate Way/5th Av NE Signal/Queue Bypass	Priority Treatment	$1.5 million	$1.5 million	$1.5 million
N 175th LT Signal Priority, SR 99 to I-5	Priority Treatment	$.1 million	$.1 million	$.1 million
Eastlake-Howell/Minor/Olive LT Priority	Priority Treatment	$1.5 million	$1.5 million	-
15th Avenue NE/NE 45th St LT Signal/Queue Bypass	Priority Treatment	$1 million	$1 million	-
Waterfront Streetcar Double Tracking	Other/Streetcar/Circulator	22,200 LF	22,200 LF	22,200 LF
I-5 Convention Pl Station to Aloha	Transitway, HOV	-	2,279 RF	-
I-5, Aloha Str to Northlake Pl	Transitway, HOV	-	1,054 RF	-
I-5, Northlake Pl to NE 55th Str	Transitway, HOV	-	5,0560 RF	-
I-5, NE 55th Str to SR 522 Inter	Transitway, HOV	-	2,300 RF	-
I-5, SR 522 Interstn	Transitway, HOV	-	2,900 RF	-
I-5, SR 522 Interstn to Northgate	Transitway, HOV	-	9,600 RF	-
I-5, Northgate to NE 103rd Str	Transitway, HOV	-	1,700 RF	-
Convention Pl to Broadway So	Rail, Guideway	-	-	2,850 RF
Broadway So to Broadway No	Rail, Guideway	-	-	2,850 RF
Broadway North to Vent Shaft	Rail, Guideway	-	-	5,500 RF
Vent Shaft	Rail, Guideway	-	-	100 RF
Portage Bay Crossing	Rail, Guideway	-	-	5,000 RF
Pacific & Brooklyn to NE 45th	Rail, Guideway	-	-	1,200 RF
NE 45th St to NE 65th St Sta	Rail, Guideway	-	-	5,800 RF
NE 65th St to Northgate Sta	Rail, Guideway	-	-	10,130 RF
Northgate Sta to 145th St Sta	Rail, Guideway	-	-	11,500 RF
145th St to NE 175th St Sta	Rail, Guideway	-	-	7,900 RF
NE 175th to Sno'sh Cty Line	Rail, Guideway	-	-	8,000 RF
Convention Place Station	Rail, Stations & Platforms	-	-	800 RF
Broadway South Station	Rail, Stations & Platforms	-	-	600 RF
Broadway North Station	Rail, Stations & Platforms	-	-	600 RF
Pacific & Brooklyn St Station	Rail, Stations & Platforms	-	-	600 RF
NE 45th Street Station (at 15th)	Rail, Stations & Platforms	-	-	600 RF
NE 65th Street Station (at 12th)	Rail, Stations & Platforms	-	-	600 RF
Northgate Station	Rail, Stations & Platforms	-	-	400 RF
145th Street Station	Rail, Stations & Platforms	-	-	400 RF
NE 175th Street Station	Rail, Stations & Platforms	-	-	400 RF
North (Snohomish County)				
I-5/52nd Avenue West Center HOF Off Ramp	Access Improvements	4,000 LF	4,000 LF	-

I-5/164th HOV Center Access Ramps to P&R Lot	Access Improvements	3,000 LF	3,000 LF	-
I-5 So/Mariner Shoulder HOV Access Ramp	Access Improvements	1,500 LF	1,500 LF	-
SR 525, SR 99 to SR 526	Arterial HOV	42,000 LF	42,000 LF	42,000 LF
SR 526, I-5 to SR 525	Vision 2020 Freeway HOV	51,200 LF	51,200 LF	51,200 LF
SR 2 HOV, I-5 - SR 9	Vision 2020 Freeway HOV	51,200 LF	51,200 LF	51,200 LF
I-5 Center HOV, Broadway to 72nd (Marysville)	Vision 2020 Freeway HOV	119,328 LF	119,328 LF	119,328 LF
SR 525, I-5 to SR 99	Vision 2020 Freeway HOV	29,,000 LF	29,000 LF	29,000 LF
I-5 Center HOV, 164th to Broadway	Core Unfunded Freeway HOV	54,384 LF	54,384 LF	54,384 LF
NB I-5 Center HOV, 195th to 164th	Core Unfunded Freeway HOV	42,000 LF	42,000 LF	42,000 LF
SB I-5 Center HOV, 236th to 44th SW Stage 1	Core Funded Freeway HOV	11,088 LF	11,088 LF	11,088 LF
Montlake Ter S Sta (236th SW) Parking	Park & Ride	-	-	1,200 cars
Montlake Ter N Sta (220th SW) Parking	Park & Ride	-	-	500 cars
Lynnwood Park & Ride Sta (44th SW) Parking	Park & Ride	-	-	500 cars
Lynnwood CBD Sta (Alderwood Mall) Parking	Park & Ride	-	-	500 cars
164th Street SW Station Parking	Park & Ride	-	-	2,000 cars
128th Street Station Parking	Park & Ride	-	-	1,500 cars
Everett Mall Station Parking	Park & Ride	-	-	1,200 cars
Broadway Station Parking	Park & Ride	-	-	1,500 cars
SR-99 & 118th Street Station Parking	Park & Ride	-	-	200 cars
Beverly Rd to Paine Field Sta Parking	Park & Ride	-	-	200 cars
Boeing Paine Field Station Parking	Park & Ride	-	-	200 cars
Everett P&R Lot	Park & Ride	-	-	200 cars
Swamp Creek P&R Lot Expansion	Park & Ride	500 cars	500 cars	-
Mariner P&R Lot Expansion	Park & Ride	75 cars	75 cars	-
I-5/164th Street P&R Lot	Park & Ride	1,000 cars	1,000 cars	-
I-5, Mountlake Terrace S 236th SW Transitway Station	Passenger Facility	-	$15 million	-
I-5, 44th Ave W Transitway Station	Passenger Facility	-	$7.7 million	-
I-5, 164th St SW Transitway Station	Passenger Facility	-	$7.6 million	-
I-5, SW 128th Mariner Square Station	Passenger Facility	-	$7.9 million	-
Everett Transit Center	Passenger Facility	$3.4 million	$3.4 million	-
SR 99 Signal/Queue Bypass, N 205th to Everett	Priority Treatment	$15 million	$15 million	$15 million
I-5, 236th Ave SW	Transitway, HOV	-	4,000 RF	-
I-5, 44th Ave W	Transitway, HOV	-	4,000 RF	-
I-5, 164th St SW	Transitway, HOV	-	4,000 RF	-
I-5, SW 128th Transitway	Transitway, HOV`	-	3,600 RF	-
S Sno'sh Cty to Montlake Ter S	Rail, Guideway	-	-	3,250 RF
Montlake S to Montlake N	Rail, Guideway	-	-	4,300 RF
Montlake N to Lynnwood P&R	Rail, Guideway	-	-	7,790 RF
Lynnwood P&R to Lynnwood CBD	Rail, Guideway	-	-	5,960 RF

Lynnwood CBD to 164th St SW	Rail, Guideway	-	-	9,000 RF
164th St SW to 128th St	Rail, Guideway	-	-	14,800 RF
128th St to Everett Mall	Rail, Guideway	-	-	12,000 RF
Everett Mall to Broadway Sta	Rail, Guideway	-	-	24,300 RF
Broadway Sta to Hewitt Sta	Rail, Guideway	-	-	5,100 RF
Hewitt Ave to Waterfront Sta	Rail, Guideway	-	-	1,000 RF
Crossover to SR-99 & 118th St Sta	Rail, Guideway	-	-	6,800 RF
SR-99 & 118th to Beverly Rd Sta	Rail, Guideway	-	-	2,800 RF
Beverly Rd to Paine Field Sta	Rail, Guideway	-	-	8,600 RF
Montlake Ter S Sta (236th SW	Rail, Stations & Platforms	-	-	400 RF
Montlake Ter N Sta (220th SW)	Rail, Stations & Platforms	-	-	400 RF
Lynnwood Park & Ride Sta (44th SW)	Rail, Stations & Platforms	-	-	400 RF
Lynnwood CBD Sta (Alderwood Mall)	Rail, Stations & Platforms	-	-	400 RF
164th Street SW Station	Rail, Stations & Platforms	-	-	400 RF
128th Street Station	Rail, Stations & Platforms	-	-	400 RF
Everett Mall Station	Rail, Stations & Platforms	-	-	400 RF
Broadway Station	Rail, Stations & Platforms	-	-	600 RF
Hewitt Ave Station	Rail, Stations & Platforms	-	-	600 RF
Waterfront Station	Rail, Stations & Platforms	-	-	600 RF
SR-99 & 118th Street Station	Rail, Stations & Platforms	-	-	400 RF
Beverly Road Station	Rail, Stations & Platforms	-	-	400 RF
Boeing Paine Field Station	Rail, Stations & Platforms	-	-	400 RF
<u>East (King County)</u>				
I-405 HOV Access Ramp at NE 8th	Access Improvements	1,500 LF	-	-
Transit Underpass Beneath NE 8th from SB I-405	Access Improvements	2,000 LF	-	-
I-405 HOV Access Ramp at NE 6th	Access Improvements	1,500 LF	-	-
Mercer Isle HOV Off Ramps at 77th and 80th	Access Improvements	3,600 LF	3,600 LF	-
I-90 Ramps to SR 900	Access Improvements	6,000 LF	6,000 LF	-
I-90 HOV Ramps at 142nd Ave S	Access Improvements	6,000 LF	6,000 LF	-
Issq-Fall City HOV, E Lk Samm/Issq Pine Lk	Access Improvements	3,560 LF	3,560 LF	3,560 LF
NE 31st St Access to SR 520	Access Improvements	4,000 LF	4,000 LF	-

NE 8th/10th HOV Couplet, Bellevue Wy to I-405	Arterial HOV	3,200 LF	3,200 LF	3,200 LF
NE 8th Contraflow Lane, I-405 to 112th	Arterial HOV	800 LF	800 LF	800 LF
NE 116th HOV, 98th Ave NE - I-405	Arterial HOV	7,170 LF	7,170 LF	7,170 LF
NE 124th HOV, I-405 - SR 202	Arterial HOV	12,032 LF	12,032 LF	12,032 LF
NE 68th/72nd, 108th Ave NE - I-405	Arterial HOV	5,120 LF	5,120 LF	5,120 LF
NE 132nd HOV, 97th - 116th Ave	Arterial HOV	5,630 LF	5,630 LF	5,630 LF
Coal Creek HOV, I-405 - Newport Way	Arterial HOV	2,500 LF	2,500 LF	2,500 LF
NE 70th HOV, I-405 - 148th Ave NE	Arterial HOV	11,520 LF	11,520 LF	11,520 LF
Bellevue Way HOV, SE 30th - I-90	Arterial HOV	1,600 LF	1,600 LF	-
SR 520 HOV Bypass Ramp, Lake Wash Blvd to SR 520	Arterial HOV	4,500 LF	4,500 LF	4,500 LF
SR 520 HOV Bypass Ramp, NB 84th NE to WB SR 520	Arterial HOV	1,500 LF	1,500 LF	1,500 LF
84th NE HOV, NE 12th to SR 520	Arterial HOV	5,120 LF	5,120 LF	5,120 LF
156th Avenue HOV, NE 31st to NE 24th	Arterial HOV	2,300 LF	2,300 LF	2,300 LF
Avondale Rd HOV, Avondale Wy to SR 202	Arterial HOV	6,140 LF	6,140 LF	-
Leary Wy HOV, Redmond Wy - SR 901	Arterial HOV	2,300 LF	2,300 LF	2,300 LF
Perimeter Road HOV, 142nd Pl to 148th Ave NE	Arterial HOV	3,000 LF	3,000 LF	3,000 LF
68th Ave NE HOV, Simonds Rd - SR 522	Arterial HOV	4,100 LF	4,100 LF	4,100 LF
I-90 Center Median HOV, E Channel to 23rd Ave S	Vision 2020 Freeway HOV	-	-	50,000 LF
I-405 Sunset - Coal Creek Stage 2	Core Unfunded Freeway HOV	42,240 LF	42,240 LF	42,240 LF
I-90 2-Way Center HOV, 23rd Av to Bellevue Way	Core Unfunded Freeway HOV	27,390 LF	27,390 LF	-
I-90 2-Way HOV, DSTT to 23rd	Core Unfunded Freeway HOV	14,080 LF	14,080 LF	-
I-90 Center Median HOV, I-405 to Issaquah	Core Unfunded Freeway HOV	77,088 LF	77,088 LF	77,088 LF
I-90 Center Median HOV, Bellevue Way to I-405	Core Unfunded Freeway HOV	10,240 LF	10,240 LF	10,240 LF
SR 520 Shoulder HOV, 108th to 124th Av NE	Core Unfunded Freeway HOV	35,840 LF	35,840 LF	35,840 LF
SR 520 Shoulder HOV, Evergreen Bridge to 108th Ave NE	Core Unfunded Freeway HOV	32,208 LF	32,208 LF	32,208 LF
SR 520 Shoulder HOV, 124th Av NE to SR 901	Core Unfunded Freeway HOV	44,032 LF	44,032 LF	44,032 LF
SR 520., HOV SR 901-SR 202	Core Unfunded Freeway HOV	10,240 LF	10,240 LF	10,240 LF
I-405 HOV, SE 8th Ave to 8th Ave NE	Core Funded Freeway HOV	11,264 LF	11,264 LF	11,264 LF
I-405 Shoulder HOV, Northup to SR 522	Core Funded Freeway HOV	92,000 LF	92,000 LF	92,000 LF
I-405 Shoulder HOV, Coal Creek to Wilburton	Core Funded Freeway HOV	14,080 LF	14,080 LF	14,080 LF

I-405, HOV Coal Creek to Wilburton Stage 2	Core Funded Freeway HOV	$41 million	$41 million	$41 million
I-405, HOV, NE 8th - Northup	Core Funded Freeway HOV	21,120 LF	21,120 LF	21,120 LF
SB I-405 to WB I-90 Ramp (No-Build)	Core Funded Freeway HOV	$26 million	$26 million	$26 million
Is Crest Station Parking	Park & Ride	-	-	500 cars
I-90/I-405 Transfer Station Parking	Park & Ride	-	-	500 cars
Wilburton Station Parking	Park & Ride	-	-	450 cars
Northup Station Parking	Park & Ride	-	-	1,000 cars
Sherwood Forest Station (Grp Health) Parking	Park & Ride	-	-	500 cars
Evergreen Station Parking	Park & Ride	-	-	500 cars
NE 51st St Station Parking	Park & Ride	-	-	250 cars
Redmond Terminal Parking	Park & Ride	-	-	1,500 cars
Houghton Station Parking	Park & Ride	-	-	700 cars
Kirkland Station Parking	Park & Ride	-	-	750 cars
Totem Lake Station Parking (Kingsgate)	Park & Ride	-	-	500 cars
Brickyard Station Parking	Park & Ride	-	-	1,000 cars
Bothell Station Parking	Park & Ride	-	-	500 cars
Newport/112th Station Parking	Park & Ride	-	-	500 cars
May Creek Station Parking	Park & Ride	-	-	500 cars
Eastgate Station Parking	Park & Ride	-	-	1,000 cars
North Issaquah Station Parking	Park & Ride	-	-	800 cars
Brickyard Road P&R Lot Expansion	Park & Ride	300 cars	300 cars	-
Wilburton P&R Lot Expansion	Park & Ride	150 cars	150 cars	-
Kingsgate P&R Lot Expansion	Park & Ride	200 cars	200 cars	-
Mercer Island P&R Lot Expansion	Park & Ride	450 cars	450 cars	-
I-90 Highpoint Flyer Stop/P&R Expansion	Park & Ride	100 cars	100 cars	-
Eastgate P&R Lot Expansion	Park & Ride	500 cars	500 cars	-
I-90 Front Street P&R Lot	Park & Ride	200 cars	200 cars	-
Lakemont P&R Lot	Park & Ride	500 cars	500 cars	-
S Kirkland P&R Lot Expansion	Park & Ride	400 cars	400 cars	400 cars
Bear Creek P&R Lot Expansion	Park & Ride	150 cars	150 cars	-
SR 520/NE 51st P&R Lot	Park & Ride	500 cars	500 cars	-
Bothell P&R Expansion	Park & Ride	250 cars	250 cars	-
Wilburton Transitway Station	Passenger Facility	-	$11 million	-
Lakemont Station (I-90/SR 901)	Passenger Facility	$13 million	$13 million	-
Kirkland Hub Expansion	Passenger Facility	$1.7 million	$1.7 million	$1.7 million
Redmond Transit Hub	Passenger Facility	$3.4 million	$3.4 million	-
NE 8th LT Signal Priority at 112th	Priority Treatment	$.03 million	$.03 million	$.03 million
NE 6th Signal Priority, 108th to 114th	Priority Treatment	$.1 million	$.1 million	$.1 million
156th St LT Queue Bypass, EB 8th to NB 156th	Priority Treatment	$.5 million	$.5 million	$.5 million
SR 908 Signal/Queue Bypass, Willows Rd to I-405	Priority Treatment	$3.6 million	$3.6 million	$3.6 million
E Lk Sammamish Pkwy, I-90 - SR 202 (3 proj)	Priority Treatment	$3.3 million	$3.3 million	$3.3 million
Union Hill Rd/Avondale WB Signal/Queue Bypass	Priority Treatment	$.5 million	$.5 million	$.5 million
Union Hill Rd HOV, Avondale - 208th Ave NE - Novelty Hill	Priority Treatment	$2.1 million	$2.1 million	$2.1 million

SR 202 HOV, SR 520 - Sahalee Way	Priority Treatment	$1.6 million	$1.6 million	$1.6 million
148th NE, Bell-Red Rd - SR 520	Priority Treatment	$2.7 million	$2.7 million	$2.7 million
148th NE, Bell-Red Rd, to BCC Perimeter Rd	Priority Treatment	$2.6 million	$2.6 million	$2.6 million
Transit Center/Bellevue Way Pedestrian Corridor	Other/Streetcar/Circulator	3,840 LF	3,840 LF	-
I-405, Wilburton RR Xing to SE 8th Str	Transitway, HOV	-	1,950 LF	-
I-405, SE 8th Str to Main Str	Transitway, HOV	-	3,000 RF	-
I-405, Main Str to NE 8th Str	Transitway, HOV	-	3,000 RF	-
I-405, NE 8th Str to NE 20th Str	Transitway, HOV	-	4,800 RF	-
I-405 & I-520, NE 20th - 115th Pl NE	Transitway, HOV	-	3,600 RF	-
Inter Dist Sta to Rainier Sta	Rail, Guideway	-	-	5,796 RF
Rainier Sta to Is Crest Sta	Rail, Guideway	-	-	18,400 RF
Is Crest Sta to Belle Way SE	Rail, Guideway	-	-	10,250 RF
Bell Wy SE to I-90/I-405 Trans Sta	Rail, Guideway	-	-	4,690 RF
I-90/I-405 Transfer Sta to 50+00	Rail, Guideway	-	-	455 RF
50+00 to Wilburton Sta	Rail, Guideway	-	-	12,980 RF
Wilburton Sta to 146+00	Rail, Guideway	-	-	1,220 RF
146+00 to Civic Ctr Sta	Rail, Guideway	-	-	950 RF
Civic Ctr Sta to Bellevue Sta	Rail, Guideway	-	-	2,870 RF
Belle Sta to Belle Library Sta	Rail, Guideway	-	-	2,000 RF
Belle Library Sta to 227+00	Rail, Guideway	-	-	680 RF
227+00 to Northup	Rail, Guideway	-	-	4,680 RF
241+00 to Northup Sta	Rail, Guideway	-	-	400 RF
Northup Sta to 330+00	Rail, Guideway	-	-	5,220 RF
330+00 to Overlake Sta	Rail, Guideway	-	-	3,430 RF
Overlake Sta to Shrwd F Sta	Rail, Guideway	-	-	2,540 RF
Sherwood F Sta to Evergreen Sta	Rail, Guideway	-	-	2,730 RF
Evergreen Sta to NE 51st St Sta	Rail, Guideway	-	-	4,965 RF
NE 51st St Sta to 164th Ave Sta	Rail, Guideway	-	-	4,220 RF
164th Ave Sta to Redmond Term	Rail, Guideway	-	-	5,380 RF
Redmond Terminal Tail Track	Rail, Guideway	-	-	1,350 RF
SR 520 to Houghton Sta	Rail, Guideway	-	-	15,560 RF
Houghton Sta to Kirkland Sta	Rail, Guideway	-	-	4,310 RF
Kirkland Sta to Totem Lake Sta	Rail, Guideway	-	-	11,540 RF
Totem Lake Sta Tail Track	Rail, Guideway	-	-	530 RF
Totem Lk Tail Trk to Brickyard Sta	Rail, Guideway	-	-	9,530 RF
Brickyard Sta to Bothell Sta	Rail, Guideway	-	-	9,320 RF
Bothell Sta to Sno County Line	Rail, Guideway	-	-	3,280 RF
I-90/I-405 Sta to Newport/112th Sta	Rail, Guideway	-	-	9,140 RF
Newport/112th Sta to May Ck Sta	Rail, Guideway	-	-	10,300 RF
May Ck Sta to Kennydale Sta	Rail, Guideway	-	-	6,160 RF
I90/I405 Trans Sta to E.gate Sta	Rail, Guideway	-	-	6,675 RF
Eastgate Sta to Lakemont Sta	Rail, Guideway	-	-	13,700 RF
Lakemont Sta to N Issaquah Sta	Rail, Guideway	-	-	14,140 RF
N Issaquah Sta to Dwtn Issaquah Sta	Rail, Guideway	-	-	8,160 RF
Rainier Station	Rail, Stations & Platforms	-	-	400 RF
Is Crest Station	Rail, Stations & Platforms	-	-	400 RF
I-90/I-405 Transfer Station (Shell only)	Rail, Stations & Platforms	-	-	695 RF

Wilburton Station	Rail, Stations & Platforms	-	-	400 RF
Civic Center Station	Rail, Stations & Platforms	-	-	400 RF
Bellevue Station	Rail, Stations & Platforms	-	-	600 RF
Bellevue Library Station	Rail, Stations & Platforms	-	-	600 RF
Northup Station	Rail, Stations & Platforms	-	-	400 RF
Overlake Station	Rail, Stations & Platforms	-	-	400 RF
Sherwood Forest Station (Grp Health)	Rail, Stations & Platforms	-	-	400 RF
Evergreen Station	Rail, Stations & Platforms	-	-	400 RF
NE 51st St Station	Rail, Stations & Platforms	-	-	400 RF
164th Ave Station	Rail, Stations & Platforms	-	-	400 RF
Redmond Terminal	Rail, Stations & Platforms	-	-	400 RF
Houghton Station	Rail, Stations & Platforms	-	-	400 RF
Kirkland Station	Rail, Stations & Platforms	-	-	400 RF
Totem Lake Station	Rail, Stations & Platforms	-	-	400 RF
Brickyard Station	Rail, Stations & Platforms	-	-	400 RF
Bothell Station	Rail, Stations & Platforms	-	-	400 RF
I90/I405 Transfer Station Finish (2 Stations)	Rail, Stations & Platforms	-	-	400 RF
Newport/112th Station	Rail, Stations & Platforms	-	-	400 RF
May Creek Station	Rail, Stations & Platforms	-	-	400 RF
Eastgate Station	Rail, Stations & Platforms	-	-	400 RF
Lakemont Station	Rail, Stations & Platforms	-	-	400 RF
North Issaquah Station	Rail, Stations & Platforms	-	-	400 RF
Downtown Issaquah Station	Rail, Stations & Platforms	-	-	400 RF
East (Snohomish County)				
SR 527 HOV, 208th - 228th SW	Arterial HOV	15,360 LF	15,360 LF	15,360 LF
I-405 Shoulder HOV, SR 522 to Swamp Creek IC	Vision 2020 Freeway HOV	65,472 LF	65,472 LF	65,472 LF
SR 522 HOV, I-405 to Snohomish River	Vision 2020 Freeway HOV	90,514 LF	90,514 LF	90,514 LF

Canyon Park Station Parking	Park & Ride	-	-	500 cars
Damson Station Parking	Park & Ride	-	-	400 cars
Canyon Park P&R Lot	Park & Ride	400 cars	400 cars	-
Sno Cnty Line to Canyon Park Sta	Rail, Guideway	-	-	9,790 RF
Canyon Park Sta to Damson Sta	Rail, Guideway	-	-	10,940 RF
Damson Sta to I-5 Median	Rail, Guideway	-	-	8,470 RF
Canyon Park Station	Rail, Stations & Platforms	-	-	400 RF
Damson Station	Rail, Stations & Platforms	-	-	400 RF
South (King County)				
I-5/Federal Way Center Access Ramp near S 320th St	Access Improvements	3,600 LF	3,600 LF	-
E-3/Spokane/I-5 So Center Access Ramp	Access Improvements	8,900 LF	-	-
HOV Acc Ramp @ 1st Ave So Bridge	Access Improvements	4,000 LF	4,000 LF	4,000 LF
I-90 Dearborn Ramps/Transitway	Access Improvements	$23 million	$23 million	-
Spokane Viaduct Transit Ramp to 4th Av S	Access Improvements	3,000 LF	3,000 LF	3,000 LF
S 192nd HOV, 148th Ave SE - SR 167	Arterial HOV	35,840 LF	35,840 LF	35,840 LF
S 272nd Ext, Kent Kangley Rd - SR 167	Arterial HOV	35,840 LF	35,840 LF	35,840 LF
SR 900 HOV Lane, I-5 to S 129th	Arterial HOV	9,240 LF	9,240 LF	9,240 LF
SR 169 HOV, Cedar Grove - I-405	Arterial HOV	75,520 LF	75,520 LF	75,520 LF
SR 509 HOV, Cloverdale - SR 518	Vision 2020 Freeway HOV	45,260 LF	45,260 LF	45,260 LF
SR 518 HOV, SR 509 to I-5	Vision 2020 Freeway HOV	37,720 LF	37,720 LF	37,720 LF
SR 167, HOV, 15th SW to Main Stage 3	Core Unfunded Freeway HOV	$10 million	$10 million	$10 million
I-5 Center HOV, Tukwila to S 320th Stage 1,2,3	Core Unfunded Freeway HOV	111,640 LF	111,640 LF	111,640 LF
I-5 Center HOV, PC Line to S 320th	Core Unfunded Freeway HOV	45,260 LF	45,260 LF	45,260 LF
SR 167 Shoulder HOV Lane, Grade to Main Stages 1&2	Core Funded Freeway HOV	124,080 LF	124,080 LF	124,080 LF
I-5 Center HOV, Boeing Access/Lucille to Tukwila	Core Funded Freeway HOV	41,480 LF	41,480 LF	41,480 LF
Boeing Station Parking	Park & Ride	-	-	2,000 cars
SR99/518 Station Parking	Park & Ride	-	-	500 cars
Kent/Des Moines Station Parking	Park & Ride	-	-	1,200 cars
Star Lake Station Parking	Park & Ride	-	-	1,200 cars
Federal Way Station Parking	Park & Ride	-	-	700 cars
So 348th St Station Parking	Park & Ride	-	-	500 cars
Tukwila Station Parking	Park & Ride	-	-	700 cars
South Renton Station Parking	Park & Ride	-	-	200 cars
North Renton Station Parking	Park & Ride	-	-	200 cars
Kennydale Station Parking	Park & Ride	-	-	200 cars
SR 167/S 277th P&R Lot	Park & Ride	400 cars	400 cars	-
Kent-Des Moines P&R Lot Expansion	Park & Ride	500 cars	500 cars	-

Star Lake P&R Lot Expansion	Park & Ride	400 cars	400 cars	-
Federal Way P&R Lot Expansion	Park & Ride	400 cars	400 cars	-
Tukwila P&R Lot Expansion	Park & Ride	150 cars	150 cars	-
I-405/Kennydale P&R Lot	Park & Ride	200 cars	200 cars	-
S Renton P&R Expansion	Park & Ride	400 cars	400 cars	-
E3 Busway Transitway Station	Passenger Facility	-	$3.9 million	-
Spokane St Transitway Station	Passenger Facility	-	$6.2 million	-
Boeing Access Transitway Station	Passenger Facility	-	$5.3 million	-
Burien Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	-
Kent Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	-
Auburn Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	-
I-5/Kent-Des Moines Station at SR 516	Passenger Facility	$37 million	$37 million	-
Star Lake I-5 Station	Passenger Facility	$13 million	$13 million	-
Federal Way Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	-
Southcenter Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	-
SeaTac Hub Improvements	Passenger Facility	$3.4 million	$3.4 million	-
Henderson Transit Hub	Passenger Facility	$3.4 million	$3.4 million	-
S Renton Hub Improvements	Passenger Facility	$1.7 million	$1.7 million	-
West Seattle Transit Hub	Passenger Facility	$3.4 million	$3.4 million	$3.4 million
S 192nd/195th at SR 515 Signal/Queue Bypass	Priority Treatment	$1 million	$1 million	$1 million
S 192nd/195th at E Valley Signal/Queue Bypass	Priority Treatment	$1 million	$1 million	$1 million
S 272nd/S 277th Signal Priority/Queue Bypass	Priority Treatment	$1 million	$1 million	$1 million
S 192nd/195th at SR 181 Signal/Queue Bypass	Priority Treatment	$1 million	$1 million	$1 million
SR 516/W Meeker LT Signal Priority	Priority Treatment	$.5 million	$.5 million	$.5 million
SR 516 at I-5 Signal Priority/Queue Bypass	Priority Treatment	$.5 million	$.5 million	$.5 million
Rainier Av Express Wire, Dearborn to Graham	Priority Treatment	$28 million	$28 million	-
Rainier Av TSM Treatments	Priority Treatment	$.5 million	$.5 million	$.5 million
Spokane Street Intersection	Transitway, HOV	-	2,640 RF	-
I-5, Spokane to Boeing Access Intersection	Transitway, HOV	-	23,600 RF	-
I-5, Boeing Access Intersection	Transitway, HOV	-	1,760 RF	-
I-5 Boeing Access to SR-599	Transitway, HOV	-	7,000 RF	-
I-5, SR-599 Intersection	Transitway, HOV	-	5,240 RF	-
Start Almnt #3 to I-90/Rainier Sta	Rail, Guideway	-	-	2,930 RF
Rainier/I-90 Sta to McClellan Sta	Rail, Guideway	-	-	4,590 RF
McClellan Sta to Martin L King W	Rail, Guideway	-	-	150 RF
Martin L King W 130+20 to 172+00	Rail, Guideway	-	-	4,180 RF
Martin L King W to Graham Station	Rail, Guideway	-	-	7,010 RF
Graham Sta to Henderson Sta	Rail, Guideway	-	-	7,050 RF
Henderson Sta to Juneau Str	Rail, Guideway	-	-	1,580 RF
Juneau Str to Boeing Sta	Rail, Guideway	-	-	9,890 RF
Boeing Sta to over Hwy 99	Rail, Guideway	-	-	745 RF
SR99 to SR99/518 Sta	Rail, Guideway	-	-	13,525 RF
SR99/518 Sta to N Airport Acc Rd	Rail, Guideway	-	-	2,140 RF
N Airport Acc Rd to SeaTac Air Sta	Rail, Guideway	-	-	7,810 RF
SeaTac Airport Sta to S 192nd Str	Rail, Guideway	-	-	4,270 RF
S 192nd Str to SeaTac Town Ctr Sta	Rail, Guideway	-	-	2,990 RF

SeaTac Town Ctr Sta to 24th Ave S	Rail, Guideway	-	-	3,360 RF
24th Ave S to Kent/Des Moines Sta	Rail, Guideway	-	-	10,590 RF
Kent/Des Mo Sta to Midway Landfill	Rail, Guideway	-	-	1,640 RF
Midway Landfill to Star Lake Sta	Rail, Guideway	-	-	8,260 RF
Star Lake Sta to Federal Way Sta	Rail, Guideway	-	-	17,400 RF
Federal Way Sta to the end of alt	Rail, Guideway	-	-	840 RF
I-5, Fed Way/70th Ave Sta	Rail, Guideway	-	-	6,200 RF
I-5, Sta to County Line Sta	Rail, Guideway	-	-	14,100 RF
Burien Station/SR99	Rail, Guideway	-	-	12,750 RF
SR99/Tukwila	Rail, Guideway	-	-	11,390 RF
Tukwila/S Renton	Rail, Guideway	-	-	9,930 RF
S Renton/N Renton	Rail, Guideway	-	-	8,130 RF
N Renton/Kennydale	Rail, Guideway	-	-	7,790 RF
I-90/Rainier Station	Rail, Stations & Platforms	-	-	600 RF
McClellan Station	Rail, Stations & Platforms	-	-	600 RF
Graham Station	Rail, Stations & Platforms	-	-	400 RF
Henderson Station	Rail, Stations & Platforms	-	-	400 RF
Boeing Station	Rail, Stations & Platforms	-	-	400 RF
SR99/518 Station	Rail, Stations & Platforms	-	-	400 RF
SeaTac Airport Station	Rail, Stations & Platforms	-	-	400 RF
SeaTac Town Center Station	Rail, Stations & Platforms	-	-	600 RF
Kent/Des Moines Station	Rail, Stations & Platforms	-	-	400 RF
Star Lake Station	Rail, Stations & Platforms	-	-	400 RF
Federal Way Station	Rail, Stations & Platforms	-	-	400 RF
So 348th St Station	Rail, Stations & Platforms	-	-	400 RF
Burien Station	Rail, Stations & Platforms	-	-	400 RF
SR 99, Station	Rail, Stations & Platforms	-	-	400 RF
Tukwila Station	Rail, Stations & Platforms	-	-	400 RF
South Renton Station	Rail, Stations & Platforms	-	-	400 RF
North Renton Station	Rail, Stations & Platforms	-	-	400 RF
Kennydale Station	Rail, Stations & Platforms	-	-	400 RF
South (Pierce County)				
I-5/North Pierce HOV Access Ramp near 54th Av E	Access Improvements	3,600 LF	3,600 LF	-

SR 7 HOV, Roy Wye - SR 512	Arterial HOV	81,460 LF	81,460 LF	81,460 LF
SR 161 HOV, 176th E - SR 512	Arterial HOV`	42,240 LF	42,240 LF	42,240 LF
SR 16 HOV, I-5 - Purdy P&R	Vision 2020 Freeway HOV	150,860 LF	150,860 LF	150,860 LF
SR 512 HOV, I-5 - SR 167	Vision 2020 Freeway HOV	128,240 LF	128,240 LF	128,240 LF
SR 410 HOV, SR 167 - S Bonney Lake P&R*	Vision 2020 Freeway HOV	111,520 LF	111,520 LF	111,520 LF
SR 167 HOV, SR 410 - 15th Str SW, Auburn	Vision 2020 Freeway HOV	103,512 LF	103,512 LF	103,512 LF
SR 167 HOV, SR 410 to Port Tacoma Interchange #136	Vision 2020 Freeway HOV	42,240 LF	42,240 LF	42,240 LF
I-5 Center HOV, SR 512 to PC Line		128,240 LF	128,240 LF	128,240 LF
70th Ave East Station Parking	Park & Ride	-	-	500 cars
Tacoma Dome Station Parking	Park & Ride	-	-	2,000 cars
84th Street South P&R Lot	Park & Ride	700 cars	700 cars	700 cars
North Pierce P&R Lot, near 54th Avenue E	Park & Ride	1,000 cars	1,000 cars	-
Tacoma Dome P&R Lot Expansion	Park & Ride	1,000 cars	1,000 cars	-
84th St I-5 Station	Passenger Facility	$13 million	$13 million	$13 million
County Line 1420+00 to 1469+00	Rail, Guideway	-	-	4,900 RF
I-5, Sta 1473+00 to 1480+00	Rail, Guideway	-	-	700 RF
I-5/Fife, Sta	Rail, Guideway	-	-	22,080 RF
Tacoma Dome to 16th St Sta	Rail, Guideway	-	-	6,080 RF
16th Street Sta to 7th St Sta	Rail, Guideway	-	-	2,090 RF
70th Ave East Station	Rail, Stations & Platforms	-	-	400 RF
Tacoma Dome Station	Rail, Guideway	-	-	400 RF
16th St Station	Rail, Guideway	-	-	400 RF
7th Street Station	Rail, Guideway	-	-	400 RF

TECHNICAL APPENDIX C

TRANSIT RIDERSHIP DETAILS

HOUSEHOLD AND EMPLOYMENT FORECASTS

APPENDIX

Transit Ridership Details For Each Alternative:

1990 and 2020 (Adopted) Transit Trips (Six-by-Six Summaries)

2020 (Adopted) PM Peak Period and Total Daily Transit Trip Tables (27-by-27 District Level)

27-District Map

1990 and 2020 (Adopted) Daily Transit Attractions by Subarea and Access Market

1990 and 2020 (Adopted) Daily Transit Productions by Subarea and Access Market

Household and Employment Forecasts

Comparative Analysis of 1985 - 2020 Household and Employment Estimates at the 27- District Level

1990 and 2020 Households & Employment by Selected Activity Centers

Definition of Activity Centers (Figure)

NO-BUILD ALTERNATIVE

Table NB1
1990 Total Daily Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	15,641	928	145	344	2,999	**4,416**	1	20,058
2 North King County	928	44,297	4,380	12,429	28,316	**89,422**	64	90,414
3 East King County	145	4,380	5,330	1,551	6,702	**17,963**	20	18,128
4 South King County	344	12,429	1,551	23,987	15,997	**53,964**	81	54,389
5 Seattle CBD	2,999	28,316	6,702	15,997	27,467	**78,482**	190	81,671
King County Subtotal	**4,416**	**89,422**	**17,963**	**53,964**	**78,482**	**239,831**	**355**	**244,602**
6 Pierce County	1	64	20	81	190	**355**	19,094	19,450
Total	20,058	90,414	18,128	54,389	81,671	**244,602**	19,450	284,110

Table NB2
2020 (Adopted) Total Daily Transit Trips by Origin and Destination
NO-BUILD ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	26,202	1,913	263	616	7,674	**10,466**	7	36,675
2 North King County	1,913	46,612	7,458	13,612	33,868	**101,550**	154	103,617
3 East King County	263	7,458	11,303	2,594	11,720	**33,075**	32	33,370
4 South King County	616	13,612	2,594	33,382	22,401	**71,989**	269	72,874
5 Seattle CBD	7,674	33,868	11,720	22,401	39,817	**107,806**	577	116,057
King County Subtotal	**10,466**	**101,550**	**33,075**	**71,989**	**107,806**	**314,420**	**1,032**	**325,918**
6 Pierce County	7	154	32	269	577	**1,032**	24,862	25,901
Total	36,675	103,617	33,370	72,874	116,057	**325,918**	25,901	388,494

Table NB3
1990 PM Peak Period Transit Trips

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,020	215	94	75	12	396	0	5,416
2 North King County	522	10,966	2,106	4,196	1,564	18,832	22	19,376
3 East King County	34	800	1,629	356	160	2,945	0	2,979
4 South King County	174	2,862	778	6,252	747	10,639	38	10,851
5 Seattle CBD	2,802	16,297	5,524	10,405	5,598	37,824	157	40,783
King County Subtotal	**3,532**	**30,925**	**10,037**	**21,209**	**8,069**	**70,240**	**217**	**73,989**
6 Pierce County	1	9	0	11	2	22	5,672	5,695
Total	8,553	31,149	10,131	21,295	8,083	70,658	5,889	85,100

Table NB4
2020 (Adopted) PM Peak Period Transit Trips
NO-BUILD ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	8,818	312	85	88	16	501	0	9,319
2 North King County	1,235	11,600	3,923	5,195	2,411	23,129	70	24,434
3 East King County	151	1,345	3,765	764	343	6,217	0	6,368
4 South King County	406	2,798	1,206	9,082	1,095	14,181	135	14,722
5 Seattle CBD	7,059	17,825	9,394	14,300	7,421	48,940	490	56,489
King County Subtotal	**8,851**	**33,568**	**18,288**	**29,341**	**11,270**	**92,467**	**695**	**102,013**
6 Pierce County	7	24	0	60	4	88	7,217	7,312
Total	17,676	33,904	18,373	29,489	11,290	93,056	7,912	118,644

Table NB5
1990 Non-Peak Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,600	192	18	95	184	489	0	6,089
2 North King County	192	22,365	1,474	5,371	10,455	39,665	33	39,890
3 East King County	18	1,474	2,072	418	1,017	4,981	20	5,019
4 South King County	95	5,371	418	11,482	4,845	22,116	33	22,244
5 Seattle CBD	184	10,455	1,017	4,845	16,271	32,588	31	32,803
King County Subtotal	**489**	**39,665**	**4,981**	**22,116**	**32,588**	**99,350**	**117**	**99,956**
6 Pierce County	0	33	20	33	31	117	7,749	7,866
Total	6,089	39,890	5,019	22,244	32,803	99,956	7,866	113,911

Table NB6
2020 (Adopted) Non-Peak Transit Trips by Origin and Destination
NO-BUILD ALTERNATIVE

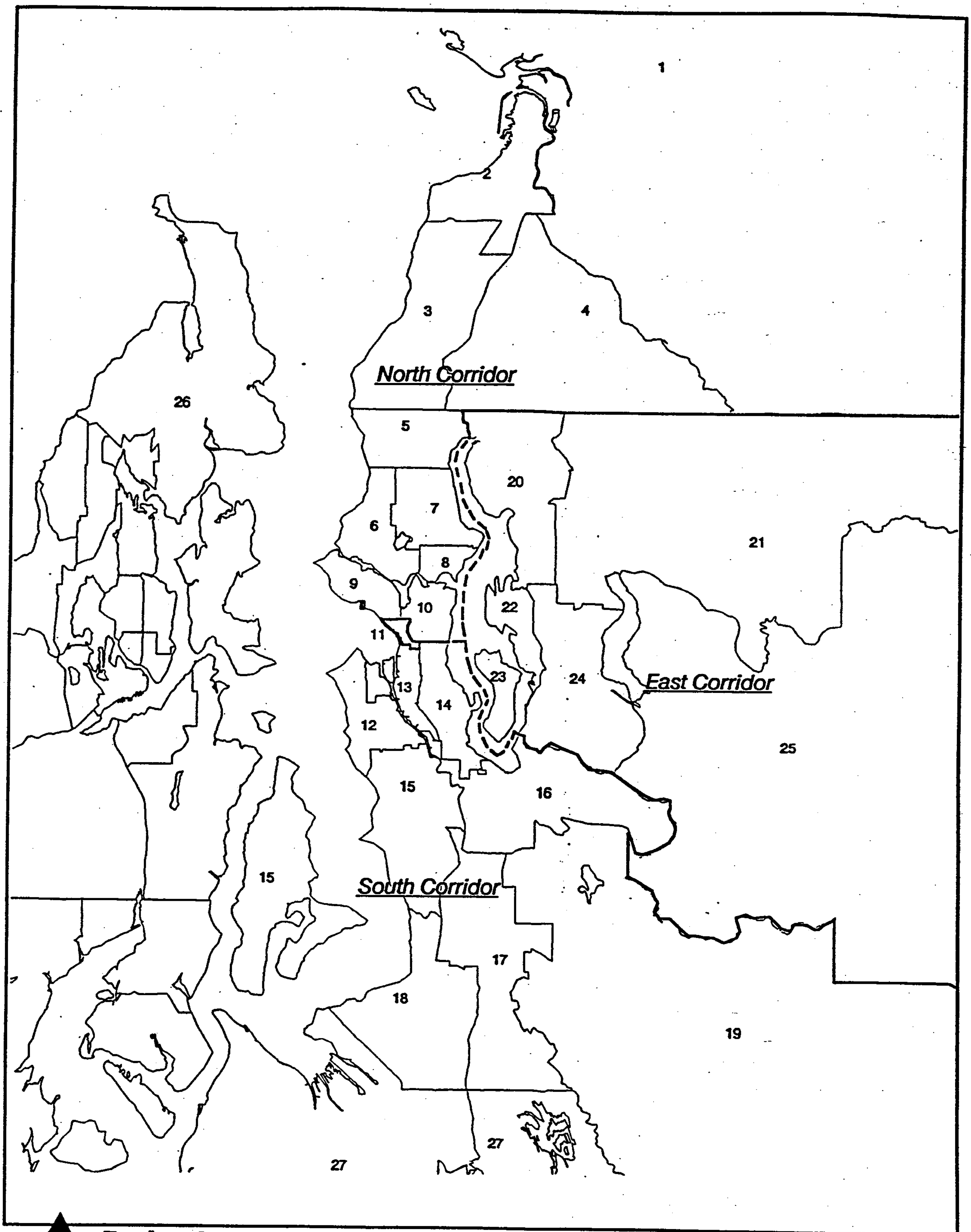
Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	8,567	366	28	122	600	1,116	0	9,683
2 North King County	366	23,412	2,191	5,619	13,632	44,854	60	45,280
3 East King County	28	2,191	3,773	624	1,982	8,570	32	8,630
4 South King County	122	5,619	624	15,218	7,007	28,468	74	28,664
5 Seattle CBD	600	13,632	1,982	7,007	24,975	47,596	83	48,279
King County Subtotal	**1,116**	**44,854**	**8,570**	**28,468**	**47,596**	**129,488**	**249**	**130,853**
6 Pierce County	0	60	32	74	83	249	10,428	10,677
Total	9,683	45,280	8,630	28,664	48,279	130,853	10,677	151,213

Table NB7
2020 (Adopted) Total Daily Transit Trips By Origin and Destination
NO-BUILD ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
1 N Snohomish	782	3361	362	80	0	0	4	119	0	29	428	0	0	29	0	18	5	0	0	6	3	23	0	14	5	8	0	5,276
2 Everett	3361	6211	1649	617	0	36	19	4	9	37	421	2	0	19	0	56	22	0	12	29	5	3	0	23	4	0	0	12,539
3 Alderwood	362	1649	4393	1081	47	78	72	499	149	288	4491	57	109	90	26	25	1	9	0	24	18	60	2	8	14	17	7	13,576
4 N Creek	80	617	1081	502	70	19	19	203	67	147	2330	2	57	24	0	35	6	0	0	0	18	0	3	0	0	0	0	5,280
5 Shoreline	0	0	47	70	420	461	534	504	144	442	2347	63	51	153	60	115	25	57	0	133	90	180	9	20	1	37	5	5,968
6 Ballard	0	36	78	19	461	3745	1308	2301	903	1659	6650	344	225	485	222	146	55	63	8	168	79	90	23	150	10	98	5	19,331
7 N Seattle	4	19	72	19	534	1308	1645	2282	414	1306	5988	149	149	608	160	137	63	31	21	288	62	190	30	82	26	83	8	15,678
8 U District	119	4	499	203	504	2301	2282	1796	490	2950	3925	237	111	817	460	264	145	317	153	1032	893	610	106	725	127	403	68	21,541
9 Queen Anne	0	9	149	67	144	903	414	490	953	1435	5480	398	148	522	247	161	62	121	43	205	147	75	23	125	32	155	10	12,518
10 Capital Hill	29	37	288	147	442	1659	1306	2950	1435	3789	8511	894	343	2816	723	423	231	325	98	484	489	244	83	263	159	360	59	28,587
11 Seattle CBD	428	421	4491	2330	2347	6650	5988	3925	5480	8511	39504	4494	576	5364	3125	1961	1902	3146	1447	3806	2962	959	465	2203	1178	325	577	114,565
12 W Seattle	0	2	57	2	63	344	149	237	398	894	4494	3187	379	498	651	169	60	98	48	50	35	51	5	30	8	26	0	11,935
13 Duwamish	0	0	109	57	51	225	149	111	148	343	576	379	54	241	303	142	170	194	125	63	93	25	26	28	34	68	62	3,776
14 S Seattle	29	19	90	24	153	485	608	817	522	2816	5364	498	241	3554	323	422	78	182	27	79	83	81	53	75	22	70	19	16,734
15 Sea-Tac	0	0	26	0	60	222	160	460	247	723	3125	651	303	323	1810	581	188	1073	93	40	36	91	6	38	7	67	28	10,358
16 Renton	18	56	25	35	115	146	137	264	161	423	1961	169	142	422	581	1999	678	420	796	214	159	271	14	416	98	48	58	9,826
17 Kent	5	22	1	6	25	55	63	145	62	231	1902	60	170	78	188	678	1194	382	639	10	47	30	1	121	7	3	9	6,134
18 Federal Way	0	0	9	0	57	63	31	317	121	325	3146	98	194	182	1073	420	382	1427	206	17	0	24	3	6	2	24	25	8,152
19 SE King County	0	12	0	0	0	8	21	153	43	98	1447	48	125	27	93	796	639	206	289	17	0	40	0	30	0	0	0	4,092
20 North Shore	6	29	24	0	133	168	288	1032	205	484	3806	50	63	79	40	214	10	17	17	863	433	708	15	242	35	40	32	9,033
21 Redmond	3	5	18	18	90	79	62	893	147	489	2962	35	93	83	36	159	47	0	0	433	563	559	16	406	113	52	0	7,361
22 Bellevue	23	3	60	0	180	90	190	610	75	244	959	51	25	81	91	271	30	24	40	708	559	364	107	1212	90	18	0	6,105
23 Mercer Island	0	0	2	3	9	23	30	106	23	83	465	5	26	53	6	14	1	3	0	15	16	107	60	81	0	29	0	1,160
24 Eastgate	14	23	8	0	20	150	82	725	125	263	2203	30	28	75	38	416	121	6	30	242	406	1212	81	831	135	2	0	7,266
25 Issaquah	5	4	14	0	1	10	26	127	32	159	1178	8	34	22	7	98	7	2	0	35	113	90	0	135	322	12	0	2,441
26 Kitsap County	8	0	17	0	37	98	83	403	155	360	325	26	68	70	67	48	3	24	0	40	52	18	29	2	12	1363	69	3,377
27 Pierce County	0	0	7	0	5	5	8	68	10	59	577	0	62	19	28	58	9	25	0	32	0	0	0	0	0	69	24862	25,903
TOTAL	5,276	12,539	13,576	5,280	5,968	19,331	15,678	21,541	12,518	28,587	114,565	11,935	3,776	16,734	10,358	9,826	6,134	8,152	4,092	9,033	7,361	6,105	1,160	7,266	2,441	3,377	25,903	388,512

Table NB8
2020 (Adopted) PM Peak Period Transit Trips
NO-BUILD ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
1 N Snohomish	294	177	8	31	0	0	4	44	0	6	0	0	0	0	0	0	5	0	0	6	3	0	0	0	4	4	0	586
2 Everett	2546	1859	624	349	0	16	19	0	6	6	0	0	0	0	0	40	16	0	9	29	5	3	0	19	4	0	0	5,550
3 Alderwood	285	458	1223	580	5	9	11	128	2	4	13	2	0	1	1	0	1	0	0	3	8	0	1	0	0	12	0	2,747
4 N Creek	36	71	116	155	0	0	3	51	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	436
5 Shoreline	0	0	21	64	97	125	114	37	14	65	66	25	1	61	8	40	0	9	0	45	32	9	5	3	0	8	3	852
6 Ballard	0	6	45	13	69	817	265	211	188	267	233	99	10	103	68	14	17	21	8	63	29	10	9	15	10	55	0	2,645
7 N Seattle	0	0	28	12	136	372	367	241	58	234	206	37	5	157	42	19	5	13	15	110	12	52	17	34	2	50	2	2,226
8 U District	55	4	235	115	296	942	1006	398	150	941	501	146	29	421	254	159	86	223	106	705	642	286	61	416	112	293	30	8,612
9 Queen Anne	0	4	128	57	59	315	153	80	226	317	243	176	12	168	111	56	36	68	24	140	103	27	6	52	19	116	9	2,705
10 Capital Hill	21	31	253	143	202	588	543	390	456	862	529	364	38	965	289	162	158	228	78	305	262	70	38	94	125	172	26	7,392
11 Seattle CBD	407	397	4100	2155	1883	3885	4050	1373	2881	3698	7271	2677	202	2666	2147	1346	1470	2405	1235	3175	2509	596	387	1808	886	286	490	56,385
12 W Seattle	0	0	42	0	16	87	36	17	67	78	182	708	33	141	143	19	7	27	24	10	9	8	0	10	6	5	0	1,675
13 Duwamish	0	0	101	47	32	147	98	37	100	168	107	189	17	137	174	88	136	147	106	53	81	14	21	27	23	59	48	2,157
14 S Seattle	21	19	64	24	30	150	194	89	107	491	302	140	19	721	112	134	31	80	21	53	15	11	16	25	9	42	14	2,934
15 Sea-Tac	0	0	8	0	16	56	51	12	28	108	130	139	2	59	383	61	58	274	40	12	7	7	0	5	7	10	7	1,480
16 Renton	18	0	16	35	56	57	61	28	40	96	78	86	5	103	279	550	329	278	385	182	90	54	9	186	89	40	44	3,194
17 Kent	0	0	0	6	24	16	40	6	10	10	39	29	2	17	39	80	315	61	152	8	30	17	0	98	7	3	2	1,011
18 Federal Way	0	0	5	0	30	17	0	13	32	26	108	27	6	12	307	41	161	399	45	0	0	0	0	0	0	8	3	1,240
19 SE King County	0	0	0	0	0	0	0	8	2	4	14	7	0	0	29	177	193	82	89	0	0	0	0	0	0	0	0	605
20 North Shore	0	0	6	0	31	39	67	60	26	61	65	10	0	3	20	11	0	6	17	303	193	15	8	66	27	15	0	1,049
21 Redmond	0	0	7	18	40	31	31	69	7	131	79	11	0	40	4	53	11	0	0	88	172	38	0	78	56	40	0	1,004
22 Bellevue	23	0	55	0	106	55	104	87	28	75	59	30	1	24	51	147	9	16	29	497	384	102	68	560	74	0	0	2,584
23 Mercer Island	0	0	0	0	3	12	2	5	10	21	5	3	1	20	1	5	0	2	0	1	10	9	21	25	0	23	0	179
24 Eastgate	14	4	8	0	9	40	30	38	31	83	51	8	0	26	13	133	18	4	27	83	220	178	40	240	59	0	0	1,357
25 Issaquah	0	0	14	0	0	0	4	0	4	6	7	1	0	8	0	1	0	1	0	0	6	2	0	12	130	0	0	196
26 Kitsap County	3	0	0	0	0	17	13	12	0	21	4	3	0	12	0	0	0	0	0	3	12	11	4	2	7	392	17	533
27 Pierce County	0	0	7	0	0	4	0	10	0	11	4	0	8	0	0	0	2	4	0	0	0	0	0	0	0	46	7217	7,313
TOTAL	3,723	3,030	7,114	3,804	3,140	7,797	7,266	3,444	4,473	7,790	10,298	4,919	391	5,865	4,475	3,336	3,064	4,348	2,410	5,874	4,834	1,519	711	3,775	1,656	1,679	7,912	118,647



Regional Transit Project

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27 - District Group

System Plan EIS

FIGURE

Table NB9
1990 and 2020 (Adopted) Daily Transit Attractions by Subarea and Access Market
NO BUILD ALTERNATIVE

Attraction Area	1990 Estimated Attractions	1990 Estimated %	2020 Estimated Attractions	2020 Estimated %	Percent Increase
1 Snohomish County					
Walk	13,500	81.0%	19,900	72.8%	+47%
Drive	3,200	19.0%	7,500	27.2%	+134%
Total	16,700	100.0%	27,400	100.0%	+64%
2 North King County					
Walk	64,400	88.9%	71,000	81.3%	+10%
Drive	8,000	11.1%	16,300	18.7%	+104%
Total	72,400	100.0%	87,200	100.0%	+20%
3 East King County					
Walk	8,100	82.6%	14,000	74.0%	+73%
Drive	1,700	17.4%	4,900	26.0%	+188%
Total	9,900	100.0%	18,900	100.0%	+91%
4 South King County					
Walk	33,600	84.8%	40,200	77.6%	+20%
Drive	6,000	15.2%	11,600	22.4%	+93%
Total	39,700	100.0%	51,800	100.0%	+30%
5 Seattle CBD					
Walk	106,400	84.3%	135,700	76.2%	+28%
Drive	19,900	15.7%	42,400	23.8%	+113%
Total	126,300	100.0%	178,100	100.0%	+41%
King County Subtotal					
Walk	**212,600**	**85.6%**	**260,800**	**77.6%**	**+23%**
Drive	**35,600**	**14.4%**	**75,200**	**22.4%**	**+111%**
Total	**248,200**	**100.0%**	**336,000**	**100.0%**	**+35%**
6 Pierce County					
Walk	15,700	81.8%	18,600	74.0%	+18%
Drive	3,500	18.2%	6,500	26.0%	+86%
Total	19,200	100.0%	25,100	100.0%	+31%
TOTAL					
Walk	**241,800**	**85.1%**	**299,300**	**77.1%**	**+24%**
Drive	**42,300**	**14.9%**	**89,200**	**22.9%**	**+111%**
GRAND TOTAL	**284,100**	**100.0%**	**388,500**	**100.0%**	**+37%**

Note:

Access market is defined at the home (production) end of the trip. Consequently, the 19,900 1990 drive-access attractions in the Seattle CBD represent trips to work and other activities in the CBD that used drive-access from home to the transit system.

Table NB10
1990 and 2020 (Adopted) Daily Transit Productions by Subarea and Access Market
NO BUILD ALTERNATIVE

Production Area	1990 Estimated Productions	1990 Estimated %	2020 Estimated Productions	2020 Estimated %	Percent Increase
1 Snohomish County					
Walk	16,500	70.6%	26,300	57.3%	+59%
Drive	6,900	29.4%	19,600	42.7%	+184%
Total	23,400	100.0%	46,000	100.0%	+97%
2 North King County					
Walk	100,700	92.9%	108,700	90.6%	+8%
Drive	7,700	7.1%	11,300	9.4%	+47%
Total	108,400	100.0%	120,000	100.0%	+11%
3 East King County					
Walk	17,100	65.0%	27,100	56.7%	+58%
Drive	9,200	35.0%	20,700	43.3%	+125%
Total	26,400	100.0%	47,800	100.0%	+81%
4 South King County					
Walk	55,800	80.7%	68,400	72.7%	+23%
Drive	13,300	19.3%	25,600	27.3%	+92%
Total	69,100	100.0%	94,000	100.0%	+36%
5 Seattle CBD					
Walk	35,900	96.7%	50,000	92.7%	+39%
Drive	1,200	3.3%	4,000	7.3%	+233%
Total	37,100	100.0%	54,000	100.0%	+46%
King County Subtotal					
Walk	**209,500**	**86.9%**	**254,300**	**80.5%**	**+21%**
Drive	**31,500**	**13.1%**	**61,600**	**19.5%**	**+96%**
Total	**241,000**	**100.0%**	**315,800**	**100.0%**	**+31%**
6 Pierce County					
Walk	15,800	80.1%	18,700	70.0%	+18%
Drive	3,900	19.9%	8,000	30.0%	+105%
Total	19,700	100.0%	26,700	100.0%	+36%
TOTAL					
Walk	**241,800**	**85.1%**	**299,300**	**77.1%**	**+24%**
Drive	**42,300**	**14.9%**	**89,200**	**22.9%**	**+111%**
GRAND TOTAL	**284,100**	**100.0%**	**388,500**	**100.0%**	**+37%**

TSM ALTERNATIVE

Table TSM1
1990 Total Daily Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	15,641	928	145	344	2,999	**4,416**	1	20,058
2 North King County	928	44,297	4,380	12,429	28,316	**89,422**	64	90,414
3 East King County	145	4,380	5,330	1,551	6,702	**17,963**	20	18,128
4 South King County	344	12,429	1,551	23,987	15,997	**53,964**	81	54,389
5 Seattle CBD	2,999	28,316	6,702	15,997	27,467	**78,482**	190	81,671
King County Subtotal	**4,416**	**89,422**	**17,963**	**53,964**	**78,482**	**239,831**	**355**	**244,602**
6 Pierce County	1	64	20	81	190	355	19,094	19,450
Total	20,058	90,414	18,128	54,389	81,671	**244,602**	19,450	284,110

Table TSM2
2020 (Adopted) Total Daily Transit Trips by Origin and Destination
TSM ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	46,637	2,755	612	981	8,137	**12,485**	8	59,130
2 North King County	2,755	53,386	10,060	17,311	34,014	**114,771**	251	117,777
3 East King County	612	10,060	15,922	4,008	13,560	**43,550**	147	44,309
4 South King County	981	17,311	4,008	43,721	23,880	**88,920**	372	90,273
5 Seattle CBD	8,137	34,014	13,560	23,880	38,554	**110,008**	658	118,803
King County Subtotal	**12,485**	**114,771**	**43,550**	**88,920**	**110,008**	**357,249**	**1,428**	**371,162**
6 Pierce County	8	251	147	372	658	**1,428**	42,170	43,606
Total	59,130	117,777	44,309	90,273	118,803	**371,162**	43,606	473,898

Table TSM3
1990 PM Peak Period Transit Trips

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,020	215	94	75	12	396	0	5,416
2 North King County	522	10,966	2,106	4,196	1,564	18,832	22	19,376
3 East King County	34	800	1,629	356	160	2,945	0	2,979
4 South King County	174	2,862	778	6,252	747	10,639	38	10,851
5 Seattle CBD	2,802	16,297	5,524	10,405	5,598	37,824	157	40,783
King County Subtotal	**3,532**	**30,925**	**10,037**	**21,209**	**8,069**	**70,240**	**217**	**73,989**
6 Pierce County	1	9	0	11	2	22	5,672	5,695
Total	8,553	31,149	10,131	21,295	8,083	70,658	5,889	85,100

Table TSM4
2020 (Adopted) PM Peak Period Transit Trips
TSM ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	15,624	515	297	194	23	1,029	0	16,653
2 North King County	1,581	13,519	5,182	6,740	2,688	28,129	94	29,804
3 East King County	254	1,853	5,127	1,157	501	8,638	0	8,892
4 South King County	536	3,471	1,818	11,829	1,271	18,389	178	19,103
5 Seattle CBD	7,234	17,089	10,431	14,639	6,723	48,882	509	56,625
King County Subtotal	**9,605**	**35,932**	**22,558**	**34,365**	**11,183**	**104,038**	**781**	**114,424**
6 Pierce County	8	21	0	60	7	88	11,840	11,936
Total	25,237	36,468	22,855	34,619	11,213	105,155	12,621	143,013

Table TSM5
1990 Non-Peak Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,600	192	18	95	184	**489**	0	6,089
2 North King County	192	22,365	1,474	5,371	10,455	**39,665**	33	39,890
3 East King County	18	1,474	2,072	418	1,017	**4,981**	20	5,019
4 South King County	95	5,371	418	11,482	4,845	**22,116**	33	22,244
5 Seattle CBD	184	10,455	1,017	4,845	16,271	**32,588**	31	32,803
King County Subtotal	**489**	**39,665**	**4,981**	**22,116**	**32,588**	**99,350**	**117**	**99,956**
6 Pierce County	0	33	20	33	31	**117**	7,749	7,866
Total	6,089	39,890	5,019	22,244	32,803	**99,956**	7,866	113,911

Table TSM6
2020 (Adopted) Non-Peak Transit Trips by Origin and Destination
TSM ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	15,389	659	61	252	880	**1,852**	0	17,241
2 North King County	659	26,347	3,025	7,100	14,238	**50,710**	137	51,506
3 East King County	61	3,025	5,669	1,033	2,628	**12,355**	147	12,563
4 South King County	252	7,100	1,033	20,063	7,971	**36,167**	134	36,553
5 Seattle CBD	880	14,238	2,628	7,971	25,108	**49,945**	142	50,967
King County Subtotal	**1,852**	**50,710**	**12,355**	**36,167**	**49,945**	**149,177**	**560**	**151,589**
6 Pierce County	0	137	147	134	142	**560**	18,491	19,051
Total	17,241	51,506	12,563	36,553	50,967	**151,589**	19,051	187,881

Table TSM7
2020 (Adopted) Total Daily Transit Trips By Origin and Destination
TSM ALTERNATIVE

2/4/92

Destination District

Origin District	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 N Snohomish	1085	6410	906	189	0	0	7	179	0	37	459	0	0	48
2 Everett	6410	9881	3137	1574	0	83	43	6	20	55	637	6	0	37
3 Alderwood	906	3137	6315	1931	80	127	127	702	176	341	4536	79	130	124
4 N Creek	189	1574	1931	1030	128	28	38	300	93	187	2499	11	81	27
5 Shoreline	0	0	80	128	622	692	880	710	212	624	2682	115	71	273
6 Ballard	0	83	127	28	692	4148	1559	2530	962	1817	6568	387	259	569
7 N Seattle	7	43	127	38	880	1559	1822	2700	485	1528	6091	197	183	769
8 U District	179	6	702	300	710	2530	2700	1931	550	3156	4043	289	128	953
9 Queen Anne	0	20	176	93	212	962	485	550	1008	1533	5302	418	165	583
10 Capital Hill	37	55	341	187	624	1817	1528	3156	1533	3977	8277	1014	383	3236
11 Seattle CBD	459	637	4536	2499	2682	6568	6091	4043	5302	8277	38269	4445	578	5418
12 W Seattle	0	6	79	11	115	387	197	289	418	1014	4445	3425	426	614
13 Duwamish	0	0	130	81	71	259	183	128	165	383	578	426	56	276
14 S Seattle	48	37	124	27	273	569	769	953	583	3236	5418	614	276	3720
15 Sea-Tac	0	0	49	0	109	294	233	707	350	938	3430	1001	414	443
16 Renton	18	147	41	55	206	206	203	368	223	552	2148	211	138	542
17 Kent	14	46	3	10	40	92	108	197	91	321	2271	102	189	121
18 Federal Way	0	0	14	0	123	85	50	443	168	444	3475	142	189	246
19 SE King County	0	23	0	0	0	13	37	243	68	162	1711	69	138	39
20 North Shore	14	134	47	0	220	252	371	1327	265	632	4048	87	96	106
21 Redmond	7	17	32	32	149	119	89	1158	205	668	3268	62	160	128
22 Bellevue	62	13	73	0	257	118	282	720	107	301	1109	93	42	125
23 Mercer Island	0	0	5	8	24	33	57	149	33	107	544	9	38	54
24 Eastgate	23	77	12	0	40	214	138	875	193	363	2703	60	45	99
25 Issaquah	12	14	31	0	0	16	35	201	52	287	1694	18	45	30
26 Kitsap County	15	0	23	0	95	105	93	466	164	373	315	25	71	70
27 Pierce County	0	0	8	0	22	6	20	101	14	89	658	0	66	29
TOTAL	9,485	22,360	19,049	8,221	8,374	21,282	18,145	25,132	13,440	31,402	117,178	13,305	4,367	18,679

Origin District	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
1 N Snohomish	0	18	14	0	0	14	7	62	0	23	12	15	0	9,485
2 Everett	0	147	46	0	23	134	17	13	0	77	14	0	0	22,360
3 Alderwood	49	41	3	14	0	47	32	73	5	12	31	23	8	19,049
4 N Creek	0	55	10	0	0	0	32	0	8	0	0	0	0	8,221
5 Shoreline	109	206	40	123	0	220	149	257	24	40	0	95	22	8,374
6 Ballard	294	206	92	85	13	252	119	118	33	214	16	105	6	21,282
7 N Seattle	233	203	108	50	37	371	89	282	57	138	35	93	20	18,145
8 U District	707	368	197	443	243	1327	1158	720	149	875	201	466	101	25,132
9 Queen Anne	350	223	91	168	68	265	205	107	33	193	52	164	14	13,440
10 Capital Hill	938	552	321	444	162	632	668	301	107	363	287	373	89	31,402
11 Seattle CBD	3430	2148	2271	3475	1711	4048	3268	1109	544	2703	1694	315	658	117,178
12 W Seattle	1001	211	102	142	69	87	62	93	9	60	18	25	0	13,305
13 Duwamish	414	138	189	189	138	96	160	42	38	45	45	71	66	4,367
14 S Seattle	443	542	121	246	39	106	128	125	54	99	30	70	29	18,679
15 Sea-Tac	2452	823	297	1407	145	73	73	156	12	86	17	119	34	13,662
16 Renton	823	2474	1017	570	1163	352	272	348	20	525	137	58	93	12,910
17 Kent	297	1017	1643	714	1217	22	112	58	4	194	15	4	30	8,932
18 Federal Way	1407	570	714	1799	409	32	0	48	5	13	4	30	36	10,446
19 SE King County	145	1163	1217	409	375	29	0	52	0	44	0	0	0	5,937
20 North Shore	73	352	22	32	29	1066	700	941	35	399	73	58	147	11,526
21 Redmond	73	272	112	0	0	700	801	773	29	663	323	67	0	9,907
22 Bellevue	156	348	58	48	52	941	773	403	170	1470	133	25	0	7,879
23 Mercer Island	12	20	4	5	0	35	29	170	66	135	0	33	0	1,570
24 Eastgate	86	525	194	13	44	399	663	1470	135	1013	232	3	0	9,619
25 Issaquah	17	137	15	4	0	73	323	133	0	232	418	17	0	3,804
26 Kitsap County	119	58	4	30	0	58	67	25	33	3	17	1363	85	3,677
27 Pierce County	34	93	30	36	0	147	0	0	0	0	0	85	42170	43,608
TOTAL	13,662	12,910	8,932	10,446	5,937	11,526	9,907	7,879	1,570	9,619	3,804	3,677	43,608	473,898

Table TSM9
1990 and 2020 (Adopted) Daily Transit Attractions by Subarea and Access Market
TSM ALTERNATIVE

Attraction Area	1990 Estimated		2020 Estimated		Percent Increase
	Attractions	%	Attractions	%	
1 Snohomish County					
Walk	13,500	81.0%	37,500	76.3%	+178%
Drive	3,200	19.0%	11,600	23.7%	+263%
Total	16,700	100.0%	49,100	100.0%	+194%
2 North King County					
Walk	64,400	88.9%	83,900	80.2%	+30%
Drive	8,000	11.1%	20,700	19.8%	+159%
Total	72,400	100.0%	104,600	100.0%	+44%
3 East King County					
Walk	8,100	82.6%	20,600	74.9%	+154%
Drive	1,700	17.4%	6,900	25.1%	+306%
Total	9,900	100.0%	27,600	100.0%	+179%
4 South King County					
Walk	33,600	84.8%	52,000	77.1%	+55%
Drive	6,000	15.2%	15,500	22.9%	+158%
Total	39,700	100.0%	67,500	100.0%	+70%
5 Seattle CBD					
Walk	106,400	84.3%	137,800	75.4%	+30%
Drive	19,900	15.7%	44,900	24.6%	+126%
Total	126,300	100.0%	182,700	100.0%	+45%
King County Subtotal					
Walk	212,600	85.6%	294,300	77.0%	+38%
Drive	35,600	14.4%	88,000	23.0%	+147%
Total	248,200	100.0%	382,300	100.0%	+54%
6 Pierce County					
Walk	15,700	81.8%	34,500	81.2%	+120%
Drive	3,500	18.2%	8,000	18.8%	+129%
Total	19,200	100.0%	42,500	100.0%	+121%
TOTAL					
Walk	241,800	85.1%	366,300	77.3%	+51%
Drive	42,300	14.9%	107,600	22.7%	+154%
GRAND TOTAL	284,100	100.0%	473,900	100.0%	+67%

Note:

Access market is defined at the home (production) end of the trip. Consequently, the 19,900 1990 drive-access attractions in the Seattle CBD represent trips to work and other activities in the CBD that used drive-access from home to the transit system.

Table TSM10
1990 and 2020 (Adopted) Daily Transit Productions by Subarea and Access Market
TSM ALTERNATIVE

Production Area	1990 Estimated Productions	1990 Estimated %	2020 Estimated Productions	2020 Estimated %	Percent Increase
1 Snohomish County					
Walk	16,500	70.6%	45,500	65.8%	+176%
Drive	6,900	29.4%	23,700	34.2%	+243%
Total	23,400	100.0%	69,200	100.0%	+196%
2 North King County					
Walk	100,700	92.9%	118,000	90.0%	+17%
Drive	7,700	7.1%	13,000	10.0%	+69%
Total	108,400	100.0%	131,000	100.0%	+21%
3 East King County					
Walk	17,100	65.0%	35,400	58.0%	+107%
Drive	9,200	35.0%	25,700	42.0%	+179%
Total	26,400	100.0%	61,100	100.0%	+131%
4 South King County					
Walk	55,800	80.7%	81,900	72.4%	+47%
Drive	13,300	19.3%	31,200	27.6%	+135%
Total	69,100	100.0%	113,100	100.0%	+64%
5 Seattle CBD					
Walk	35,900	96.7%	50,600	92.1%	+41%
Drive	1,200	3.3%	4,300	7.9%	+258%
Total	37,100	100.0%	54,900	100.0%	+48%
King County Subtotal					
Walk	**209,500**	**86.9%**	**285,800**	**79.4%**	**+36%**
Drive	**31,500**	**13.1%**	**74,200**	**20.6%**	**+136%**
Total	**241,000**	**100.0%**	**360,100**	**100.0%**	**+49%**
6 Pierce County					
Walk	15,800	80.1%	35,000	78.3%	+122%
Drive	3,900	19.9%	9,700	21.7%	+149%
Total	19,700	100.0%	44,700	100.0%	+127%
TOTAL					
Walk	**241,800**	**85.1%**	**366,300**	**77.3%**	**+51%**
Drive	**42,300**	**14.9%**	**107,600**	**22.7%**	**+154%**
GRAND TOTAL	**284,100**	**100.0%**	**473,900**	**100.0%**	**+67%**

TRANSITWAY ALTERNATIVE

Table TWY1
1990 Total Daily Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	15,641	928	145	344	2,999	4,416	1	20,058
2 North King County	928	44,297	4,380	12,429	28,316	89,422	64	90,414
3 East King County	145	4,380	5,330	1,551	6,702	17,963	20	18,128
4 South King County	344	12,429	1,551	23,987	15,997	53,964	81	54,389
5 Seattle CBD	2,999	28,316	6,702	15,997	27,467	78,482	190	81,671
King County Subtotal	4,416	89,422	17,963	53,964	78,482	239,831	355	244,602
6 Pierce County	1	64	20	81	190	355	19,094	19,450
Total	20,058	90,414	18,128	54,389	81,671	244,602	19,450	284,110

Table TWY2
2020 (Adopted) Total Daily Transit Trips by Origin and Destination
TRANSITWAY ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	48,935	2,783	635	1,007	8,359	12,784	10	61,729
2 North King County	2,783	53,041	9,974	17,180	34,123	114,318	266	117,367
3 East King County	635	9,974	15,963	4,255	14,036	44,228	147	45,010
4 South King County	1,007	17,180	4,255	44,662	24,249	90,346	471	91,824
5 Seattle CBD	8,359	34,123	14,036	24,249	38,607	111,015	697	120,071
King County Subtotal	12,784	114,318	44,228	90,346	111,015	359,907	1,581	374,272
6 Pierce County	10	266	147	471	697	1,581	42,392	43,983
Total	61,729	117,367	45,010	91,824	120,071	374,272	43,983	479,984

Table TWY3
1990 PM Peak Period Transit Trips

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,020	215	94	75	12	396	0	5,416
2 North King County	522	10,966	2,106	4,196	1,564	18,832	22	19,376
3 East King County	34	800	1,629	356	160	2,945	0	2,979
4 South King County	174	2,862	778	6,252	747	10,639	38	10,851
5 Seattle CBD	2,802	16,297	5,524	10,405	5,598	37,824	157	40,783
King County Subtotal	**3,532**	**30,925**	**10,037**	**21,209**	**8,069**	**70,240**	**217**	**73,989**
6 Pierce County	1	9	0	11	2	22	5,672	5,695
Total	8,553	31,149	10,131	21,295	8,083	70,658	5,889	85,100

Table TWY4
2020 (Adopted) PM Peak Period Transit Trips
TRANSITWAY ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	16,114	518	300	199	23	1,040	0	17,154
2 North King County	1,620	13,477	5,039	6,582	2,616	27,714	98	29,432
3 East King County	272	1,910	5,152	1,208	529	8,799	0	9,071
4 South King County	572	3,626	1,961	12,055	1,324	18,966	201	19,739
5 Seattle CBD	7,493	17,348	10,807	14,880	6,759	49,794	545	57,832
King County Subtotal	**9,957**	**36,361**	**22,959**	**34,725**	**11,228**	**105,273**	**844**	**116,074**
6 Pierce County	10	35	0	88	8	131	12,039	12,180
Total	26,081	36,914	23,259	35,012	11,259	106,444	12,883	145,408

Table TWY5
1990 Non-Peak Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,600	192	18	95	184	489	0	6,089
2 North King County	192	22,365	1,474	5,371	10,455	39,665	33	39,890
3 East King County	18	1,474	2,072	418	1,017	4,981	20	5,019
4 South King County	95	5,371	418	11,482	4,845	22,116	33	22,244
5 Seattle CBD	184	10,455	1,017	4,845	16,271	32,588	31	32,803
King County Subtotal	**489**	**39,665**	**4,981**	**22,116**	**32,588**	**99,350**	**117**	**99,956**
6 Pierce County	0	33	20	33	31	117	7,749	7,866
Total	6,089	39,890	5,019	22,244	32,803	99,956	7,866	113,911

Table TWY6
2020 (Adopted) Non-Peak Transit Trips by Origin and Destination
TRANSITWAY ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	16,708	645	64	236	843	1,788	0	18,496
2 North King County	645	26,087	3,024	6,972	14,159	50,242	133	51,020
3 East King County	64	3,024	5,660	1,086	2,700	12,470	147	12,681
4 South King County	236	6,972	1,086	20,553	8,045	36,656	183	37,075
5 Seattle CBD	843	14,159	2,700	8,045	25,089	49,993	143	50,979
King County Subtotal	**1,788**	**50,242**	**12,470**	**36,656**	**49,993**	**149,361**	**606**	**151,755**
6 Pierce County	0	133	147	183	143	606	18,314	18,920
Total	18,496	51,020	12,681	37,075	50,979	151,755	18,920	189,171

2/4/92

Table TWY7
2020 (Adopted) Total Daily Transit Trips By Origin and Destination
TRANSITWAY ALTERNATIVE

	Destination District																											
Origin District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
1 N Snohomish	1085	6459	938	215	0	0	7	181	0	37	463	0	0	49	0	18	16	0	0	14	7	63	0	23	12	15	0	9,602
2 Everett	6459	10063	3425	1819	0	83	43	7	20	57	665	6	0	39	0	150	46	0	24	134	17	13	0	81	14	0	0	23,165
3 Alderwood	938	3425	6702	2094	79	115	126	705	177	353	4679	83	138	125	43	41	3	14	0	47	36	83	5	15	31	22	10	20,089
4 N Creek	215	1819	2094	1155	131	28	40	307	93	194	2546	13	84	28	0	60	10	0	0	0	32	0	9	0	0	0	0	8,858
5 Shoreline	0	0	79	131	622	646	839	709	206	643	2804	106	78	265	116	217	48	159	0	221	148	263	26	40	1	80	22	8,469
6 Ballard	0	83	115	28	646	4145	1555	2533	959	1820	6610	375	267	562	292	212	95	93	13	250	120	119	33	218	16	103	7	21,269
7 N Seattle	7	43	126	40	839	1555	1815	2644	480	1523	6132	186	186	752	234	201	117	51	37	372	90	292	57	150	35	90	22	18,076
8 U District	181	7	705	307	709	2533	2644	1922	528	3160	3969	251	125	936	606	349	186	416	217	1254	1072	740	139	860	187	415	100	24,518
9 Queen Anne	0	20	177	93	206	959	480	528	1008	1533	5317	410	168	580	349	226	97	194	72	277	211	108	33	206	57	163	15	13,487
10 Capital Hill	37	57	353	194	643	1820	1523	3160	1533	3977	8282	987	389	3240	962	554	341	482	171	631	650	304	109	385	300	370	100	31,554
11 Seattle CBD	463	665	4679	2546	2804	6610	6132	3969	5317	8282	38320	4359	586	5413	3469	2178	2395	3682	1768	4195	3393	1122	556	2817	1752	307	697	118,476
12 W Seattle	0	6	83	13	106	375	186	251	410	987	4359	3418	469	649	1017	239	123	170	76	92	69	92	8	64	19	25	0	13,306
13 Duwamish	0	0	138	84	78	267	186	125	168	389	586	469	57	282	422	151	202	231	155	110	183	44	40	47	48	72	74	4,608
14 S Seattle	49	39	125	28	265	562	752	936	580	3240	5413	649	282	3735	505	552	130	294	41	116	139	126	55	109	32	70	31	18,855
15 Sea-Tac	0	0	43	0	116	292	234	606	349	962	3469	1017	422	505	2443	824	304	1407	144	85	83	161	13	95	21	131	46	13,772
16 Renton	18	150	41	60	217	212	201	349	226	554	2178	239	151	552	824	2487	1034	603	1182	381	293	340	21	541	146	64	124	13,188
17 Kent	16	46	3	10	48	95	117	186	97	341	2395	123	202	130	304	1034	1626	686	1217	23	123	60	5	206	16	4	38	9,151
18 Federal Way	0	0	14	0	159	93	51	416	194	482	3682	170	231	294	1407	603	686	1792	407	38	0	53	5	14	5	35	51	10,882
19 SE King County	0	24	0	0	0	13	37	217	72	171	1768	76	155	41	144	1182	1217	407	375	31	0	50	0	44	0	0	0	6,024
20 North Shore	14	134	47	0	221	250	372	1254	277	631	4195	92	110	116	85	381	23	38	31	1067	702	938	40	402	73	59	147	11,699
21 Redmond	7	17	36	32	148	120	90	1072	211	650	3393	69	183	139	83	293	123	0	0	702	796	779	34	660	323	72	0	10,032
22 Bellevue	63	13	83	0	263	119	292	740	108	304	1122	92	44	126	161	340	60	53	50	938	779	390	161	1477	131	25	0	7,934
23 Mercer Island	0	0	5	9	26	33	57	139	33	109	556	8	40	55	13	21	5	5	0	40	34	161	66	153	0	33	0	1,601
24 Eastgate	23	81	15	0	40	218	150	860	206	385	2817	64	47	109	95	541	206	14	44	402	660	1477	153	1018	232	3	0	9,860
25 Issaquah	12	14	31	0	1	16	35	187	57	300	1752	19	48	32	21	146	16	5	0	73	323	131	0	232	418	18	0	3,887
26 Kitsap County	15	0	22	0	80	103	90	415	163	370	307	25	72	70	131	64	4	35	0	59	72	25	33	3	18	1363	107	3,646
27 Pierce County	0	0	10	0	22	7	22	100	15	100	697	0	74	31	46	124	38	51	0	147	0	0	0	0	0	107	42392	43,983
TOTAL	9,602	23,165	20,089	8,858	8,469	21,269	18,076	24,518	13,487	31,554	118,476	13,306	4,608	18,855	13,772	13,188	9,151	10,882	6,024	11,699	10,032	7,934	1,601	9,860	3,887	3,646	43,983	479,991

Table TWY8
2020 (Adopted) PM Peak Period Transit Trips
TRANSITWAY ALTERNATIVE

	Destination District																											
Origin District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
1 N Snohomish	366	263	17	62	0	0	7	56	0	10	0	0	0	0	0	0	16	0	0	14	7	0	0	0	9	8	0	835
2 Everett	4558	2993	1236	1121	0	34	43	0	13	13	0	0	0	0	0	95	33	0	19	134	17	13	0	71	14	0	0	10,407
3 Alderwood	672	941	1859	1060	8	16	18	185	3	6	16	3	0	2	1	0	3	0	0	4	13	0	3	0	0	15	0	4,828
4 N Creek	110	191	260	393	0	0	12	95	0	0	7	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,081
5 Shoreline	0	0	35	123	151	201	225	51	20	104	143	49	3	129	14	79	0	27	0	72	48	12	18	7	0	16	9	1,536
6 Ballard	0	14	55	17	85	896	312	223	199	278	231	105	10	114	88	18	26	29	13	76	37	14	13	21	16	53	0	2,943
7 N Seattle	0	0	40	17	196	430	411	278	67	291	262	54	7	212	61	27	11	26	26	131	14	92	39	78	6	55	7	2,838
8 U District	82	7	293	147	431	1096	1197	456	165	1071	537	160	31	491	379	198	109	282	138	827	716	363	76	506	167	309	37	10,271
9 Queen Anne	0	7	151	77	75	333	173	91	240	333	247	183	13	185	170	74	53	95	37	181	136	39	9	87	34	119	13	3,155
10 Capital Hill	24	45	304	182	286	667	631	417	491	907	537	400	42	1088	394	207	224	314	119	378	300	88	50	135	251	177	33	8,691
11 Seattle CBD	430	607	4171	2285	2114	3731	4031	1327	2672	3412	6622	2477	188	2518	2277	1420	1740	2676	1442	3379	2750	677	431	2219	1301	263	545	57,705
12 W Seattle	0	0	64	0	25	98	50	21	67	84	185	771	41	176	223	27	12	38	37	15	18	17	0	19	13	6	0	2,007
13 Duwamish	0	0	126	71	46	177	123	44	114	190	113	238	18	159	251	94	160	170	129	92	162	25	28	44	32	63	57	2,726
14 S Seattle	27	39	82	28	42	172	225	97	113	545	305	183	21	736	156	158	46	111	30	78	25	17	17	34	12	41	17	3,357
15 Sea-Tac	0	0	13	0	37	81	79	16	38	148	183	233	2	96	505	86	75	353	58	26	18	13	0	11	21	17	9	2,118
16 Renton	18	0	25	60	97	81	85	35	51	121	87	118	6	137	382	695	465	364	568	312	160	68	14	249	127	50	76	4,451
17 Kent	0	0	0	10	46	30	74	10	17	19	83	66	3	32	64	150	468	120	260	16	62	34	0	160	16	4	5	1,749
18 Federal Way	0	0	8	0	92	27	0	34	67	57	191	48	12	25	358	69	260	495	78	0	0	0	0	0	0	10	7	1,838
19 SE King County	0	0	0	0	0	0	0	18	6	17	30	12	0	0	45	256	391	157	119	0	0	0	0	0	0	0	0	1,051
20 North Shore	0	0	12	0	49	70	96	83	38	83	116	24	0	8	43	24	0	13	31	378	270	21	18	99	47	21	0	1,544
21 Redmond	0	0	11	32	59	43	47	117	10	211	138	20	0	64	8	91	28	0	0	151	230	47	0	121	211	53	0	1,692
22 Bellevue	63	0	76	0	135	71	151	96	41	91	70	53	1	34	97	171	18	34	35	626	520	110	97	665	102	0	0	3,357
23 Mercer Island	0	0	0	0	5	15	3	8	10	22	5	5	1	19	2	5	0	3	0	1	19	17	21	33	0	25	0	219
24 Eastgate	23	10	15	0	14	56	46	44	49	119	85	16	0	36	45	175	35	10	36	123	320	218	79	288	97	0	0	1,939
25 Issaquah	0	0	31	0	0	0	6	0	9	11	16	3	0	14	0	2	0	3	0	0	19	3	0	31	169	0	0	317
26 Kitsap County	4	0	0	0	0	20	17	14	0	22	4	3	0	12	0	0	0	0	0	5	19	15	5	3	11	392	30	576
27 Pierce County	0	0	10	0	0	5	0	15	0	15	8	0	10	0	0	0	6	12	0	0	0	0	0	0	0	59	12039	12,179
TOTAL	6,377	5,117	8,894	5,685	3,993	8,350	8,062	3,831	4,500	8,180	10,221	5,237	409	6,287	5,563	4,121	4,179	5,332	3,175	7,019	5,880	1,903	918	4,881	2,656	1,756	12,884	145,410

Table TWY9
1990 and 2020 (Adopted) Daily Transit Attractions by Subarea and Access Market
TRANSITWAY ALTERNATIVE

Attraction Area	1990 Estimated Attractions	1990 Estimated %	2020 Estimated Attractions	2020 Estimated %	Percent Increase
1 Snohomish County					
Walk	13,500	81.0%	39,000	75.9%	+189%
Drive	3,200	19.0%	12,400	24.1%	+288%
Total	16,700	100.0%	51,400	100.0%	+208%
2 North King County					
Walk	64,400	88.9%	82,700	80.3%	+28%
Drive	8,000	11.1%	20,200	19.7%	+153%
Total	72,400	100.0%	102,900	100.0%	+42%
3 East King County					
Walk	8,100	82.6%	20,900	74.6%	+158%
Drive	1,700	17.4%	7,100	25.4%	+318%
Total	9,900	100.0%	28,000	100.0%	+183%
4 South King County					
Walk	33,600	84.8%	53,300	76.7%	+59%
Drive	6,000	15.2%	16,200	23.3%	+170%
Total	39,700	100.0%	69,500	100.0%	+75%
5 Seattle CBD					
Walk	106,400	84.3%	139,500	75.3%	+31%
Drive	19,900	15.7%	45,900	24.7%	+131%
Total	126,300	100.0%	185,300	100.0%	+47%
King County Subtotal					
Walk	212,600	85.6%	296,300	76.8%	+39%
Drive	35,600	14.4%	89,400	23.2%	+151%
Total	248,200	100.0%	385,700	100.0%	+55%
6 Pierce County					
Walk	15,700	81.8%	34,500	80.6%	+120%
Drive	3,500	18.2%	8,300	19.4%	+137%
Total	19,200	100.0%	42,900	100.0%	+123%
TOTAL					
Walk	241,800	85.1%	369,900	77.1%	+53%
Drive	42,300	14.9%	110,100	22.9%	+160%
GRAND TOTAL	284,100	100.0%	480,000	100.0%	+69%

Note:

Access market is defined at the home (production) end of the trip. Consequently, the 19,900 1990 drive-access attractions in the Seattle CBD represent trips to work and other activities in the CBD that used drive-access from home to the transit system.

Table TWY10
1990 and 2020 (Adopted) Daily Transit Productions by Subarea and Access Market
TRANSITWAY ALTERNATIVE

Production Area	1990 Estimated		2020 Estimated		Percent Increase
	Productions	%	Productions	%	
1 Snohomish County					
Walk	16,500	70.6%	47,500	66.0%	+188%
Drive	6,900	29.4%	24,500	34.0%	+255%
Total	23,400	100.0%	72,100	100.0%	+208%
2 North King County					
Walk	100,700	92.9%	118,800	90.1%	+18%
Drive	7,700	7.1%	13,100	9.9%	+70%
Total	108,400	100.0%	131,800	100.0%	+22%
3 East King County					
Walk	17,100	65.0%	36,000	58.1%	+111%
Drive	9,200	35.0%	26,000	41.9%	+183%
Total	26,400	100.0%	62,000	100.0%	+135%
4 South King County					
Walk	55,800	80.7%	82,100	71.9%	+47%
Drive	13,300	19.3%	32,000	28.1%	+141%
Total	69,100	100.0%	114,100	100.0%	+65%
5 Seattle CBD					
Walk	35,900	96.7%	50,500	92.2%	+41%
Drive	1,200	3.3%	4,300	7.8%	+258%
Total	37,100	100.0%	54,800	100.0%	+48%
King County Subtotal					
Walk	**209,500**	**86.9%**	**287,400**	**79.2%**	**+37%**
Drive	**31,500**	**13.1%**	**75,400**	**20.8%**	**+139%**
Total	**241,000**	**100.0%**	**362,800**	**100.0%**	**+51%**
6 Pierce County					
Walk	15,800	80.1%	35,000	77.5%	+122%
Drive	3,900	19.9%	10,200	22.5%	+162%
Total	19,700	100.0%	45,100	100.0%	+129%
TOTAL					
Walk	**241,800**	**85.1%**	**369,900**	**77.1%**	**+53%**
Drive	**42,300**	**14.9%**	**110,100**	**22.9%**	**+160%**
GRAND TOTAL	**284,100**	**100.0%**	**480,000**	**100.0%**	**+69%**

RAIL ALTERNATIVE

Table RAIL1
1990 Total Daily Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	15,641	928	145	344	2,999	**4,416**	1	20,058
2 North King County	928	44,297	4,380	12,429	28,316	**89,422**	64	90,414
3 East King County	145	4,380	5,330	1,551	6,702	**17,963**	20	18,128
4 South King County	344	12,429	1,551	23,987	15,997	**53,964**	81	54,389
5 Seattle CBD	2,999	28,316	6,702	15,997	27,467	**78,482**	190	81,671
King County Subtotal	**4,416**	**89,422**	**17,963**	**53,964**	**78,482**	**239,831**	**355**	**244,602**
6 Pierce County	1	64	20	81	190	**355**	19,094	19,450
Total	20,058	90,414	18,128	54,389	81,671	**244,602**	19,450	284,110

Table RAIL2
2020 (Adopted) Total Daily Transit Trips by Origin and Destination
RAIL ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	51,114	3,715	733	1,306	11,938	**17,692**	10	68,816
2 North King County	3,715	58,023	11,592	21,389	41,323	**132,327**	326	136,368
3 East King County	733	11,592	16,785	5,693	18,645	**52,715**	147	53,595
4 South King County	1,306	21,389	5,693	48,717	31,188	**106,987**	583	108,876
5 Seattle CBD	11,938	41,323	18,645	31,188	43,418	**134,574**	1,006	147,518
King County Subtotal	**17,692**	**132,327**	**52,715**	**106,987**	**134,574**	**426,603**	**2,062**	**446,357**
6 Pierce County	10	326	147	583	1,006	**2,062**	43,231	45,303
Total	68,816	136,368	53,595	108,876	147,518	**446,357**	45,303	560,476

Table RAIL3
1990 PM Peak Period Transit Trips

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,020	215	94	75	12	396	0	5,416
2 North King County	522	10,966	2,106	4,196	1,564	18,832	22	19,376
3 East King County	34	800	1,629	356	160	2,945	0	2,979
4 South King County	174	2,862	778	6,252	747	10,639	38	10,851
5 Seattle CBD	2,802	16,297	5,524	10,405	5,598	37,824	157	40,783
King County	**3,532**	**30,925**	**10,037**	**21,209**	**8,069**	**70,240**	**217**	**73,989**
6 Pierce County	1	9	0	11	2	22	5,672	5,695
Total	8,553	31,149	10,131	21,295	8,083	70,658	5,889	85,100

Table RAIL4
2020 (Adopted) PM Peak Period Transit Trips
RAIL ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	16,889	707	328	232	26	1,293	0	18,182
2 North King County	2,111	14,662	5,754	8,124	2,873	31,413	126	33,650
3 East King County	323	2,279	5,438	1,638	678	10,033	0	10,356
4 South King County	735	4,357	2,447	13,188	1,512	21,504	256	22,495
5 Seattle CBD	10,780	23,567	14,848	20,928	9,125	68,468	819	80,067
King County Subtotal	**13,949**	**44,865**	**28,487**	**43,878**	**14,188**	**131,418**	**1,201**	**146,568**
6 Pierce County	10	35	0	95	8	138	12,350	12,498
Total	30,848	45,607	28,815	44,205	14,222	132,849	13,551	177,248

Table RAIL5
1990 Non-Peak Transit Trips by Origin and Destination

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	5,600	192	18	95	184	**489**	0	6,089
2 North King County	192	22,365	1,474	5,371	10,455	**39,665**	33	39,890
3 East King County	18	1,474	2,072	418	1,017	**4,981**	20	5,019
4 South King County	95	5,371	418	11,482	4,845	**22,116**	33	22,244
5 Seattle CBD	184	10,455	1,017	4,845	16,271	**32,588**	31	32,803
King County Subtotal	**489**	**39,665**	**4,981**	**22,116**	**32,588**	**99,350**	**117**	**99,956**
6 Pierce County	0	33	20	33	31	**117**	7,749	7,866
Total	6,089	39,890	5,019	22,244	32,803	**99,956**	7,866	113,911

Table RAIL6
2020 (Adopted) Non-Peak Transit Trips by Origin and Destination
RAIL ALTERNATIVE

Origin District	Destination District 1	2	3	4	5	King County Subtotal (Col. 2-5)	6	Total
1 Snohomish County	17,336	897	82	339	1,131	**2,449**	0	19,785
2 North King County	897	28,699	3,559	8,909	14,882	**56,049**	164	57,110
3 East King County	82	3,559	5,909	1,607	3,119	**14,194**	147	14,423
4 South King County	339	8,909	1,607	22,341	8,748	**41,605**	231	42,175
5 Seattle CBD	1,131	14,882	3,119	8,748	25,167	**51,916**	179	53,226
King County Subtotal	**2,449**	**56,049**	**14,194**	**41,605**	**51,916**	**163,764**	**721**	**166,934**
6 Pierce County	0	164	147	231	179	**721**	18,531	19,252
Total	19,785	57,110	14,423	42,175	53,226	**166,934**	19,252	205,971

Table RAIL7
2020 (Adopted) Total Daily Transit Trips By Origin and Destination
RAIL ALTERNATIVE

Origin District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
	Destination District																											
1 N Snohomish	1085	6468	953	218	0	0	7	259	0	37	620	0	0	57	0	18	17	0	0	14	7	63	0	23	12	15	0	9,873
2 Everett	6468	10463	3833	2009	0	102	57	8	28	78	994	6	0	51	0	156	48	0	25	136	18	14	0	91	14	0	0	24,599
3 Alderwood	953	3833	7009	2226	91	173	217	989	199	478	6735	109	168	173	71	71	3	31	0	59	64	106	10	25	31	39	10	23,873
4 N Creek	218	2009	2226	1112	152	41	58	400	94	246	3579	17	113	37	0	89	17	0	0	0	32	0	14	0	0	0	0	10,454
5 Shoreline	0	0	91	152	672	776	1021	925	232	820	3741	137	88	374	196	317	59	243	0	239	178	279	32	57	2	111	22	10,764
6 Ballard	0	102	173	41	776	4191	1645	2590	965	2056	7904	419	258	690	400	273	110	129	13	279	184	135	40	288	19	108	8	23,796
7 N Seattle	7	57	217	58	1021	1645	1881	2957	506	1928	7737	237	204	1013	361	292	137	71	49	398	113	339	78	204	41	97	24	21,670
8 U District	259	8	989	400	925	2590	2957	1940	636	3522	4858	346	148	1226	1057	510	253	674	318	1404	1264	750	196	996	278	544	122	29,170
9 Queen Anne	0	28	199	94	232	965	506	636	1008	1577	6244	449	161	677	421	249	95	265	68	276	245	124	41	263	76	164	18	15,081
10 Capital Hill	37	78	478	246	820	2056	1928	3522	1577	4022	9699	1071	413	3525	1239	686	394	632	184	684	751	339	126	480	390	377	132	35,886
11 Seattle CBD	620	994	6735	3579	3741	7904	7737	4858	6244	9699	43037	5424	638	6818	4862	2772	2968	4987	2223	5159	4705	1445	788	3787	2508	416	1006	145,654
12 W Seattle	0	6	109	17	137	419	237	346	449	1071	5424	3427	422	643	1042	229	103	176	94	98	93	102	9	74	22	29	0	14,778
13 Duwamish	0	0	168	113	88	258	204	148	161	413	638	422	58	274	438	139	181	230	137	93	176	47	43	48	57	72	76	4,682
14 S Seattle	57	51	173	37	374	690	1013	1226	677	3525	6818	643	274	3904	795	633	163	536	56	127	203	184	75	177	54	77	39	22,581
15 Sea-Tac	0	0	71	0	196	400	361	1057	421	1239	4862	1042	438	795	2535	1075	346	1729	180	133	160	271	23	143	33	143	71	17,724
16 Renton	18	156	71	89	317	273	292	510	249	686	2772	229	139	633	1075	2469	1149	947	1254	550	422	435	33	640	211	72	176	15,867
17 Kent	17	48	3	17	59	110	137	253	95	394	2968	103	181	163	346	1149	1632	739	1224	40	168	84	6	248	17	4	52	10,257
18 Federal Way	0	0	31	0	243	129	71	674	265	632	4987	176	230	536	1729	947	739	1874	441	74	0	81	8	29	11	40	70	14,017
19 SE King County	0	25	0	0	0	13	49	318	68	184	2223	94	137	56	180	1254	1224	441	375	49	0	76	0	57	0	0	0	6,823
20 North Shore	14	136	59	0	239	279	396	1404	276	684	5159	98	93	127	133	550	40	74	49	1047	711	908	42	417	73	57	147	13,212
21 Redmond	7	18	64	32	178	184	113	1264	245	751	4705	93	176	203	160	422	168	0	0	711	859	921	59	766	326	115	0	12,540
22 Bellevue	63	14	106	0	279	135	339	750	124	339	1445	102	47	184	271	435	84	81	76	908	921	376	178	1479	145	25	0	8,906
23 Mercer Island	0	0	10	14	32	40	78	196	41	126	788	9	43	75	23	33	6	8	0	42	59	178	69	173	0	38	0	2,081
24 Eastgate	23	91	25	0	57	288	204	996	263	480	3787	74	48	177	143	640	248	29	57	417	766	1479	173	1074	277	3	0	11,819
25 Issaquah	12	14	31	0	2	19	41	278	76	390	2508	22	57	54	33	211	17	11	0	73	326	145	0	277	413	22	0	5,032
26 Kitsap County	15	0	39	0	111	108	97	544	164	377	416	29	72	77	143	72	4	40	0	57	115	25	38	3	22	1363	100	4,031
27 Pierce County	0	0	10	0	22	8	24	122	18	132	1006	0	76	39	71	176	52	70	0	147	0	0	0	0	0	100	43231	45,304
TOTAL	9,873	24,599	23,873	10,454	10,764	23,796	21,670	29,170	15,081	35,886	145,654	14,778	4,682	22,581	17,724	15,867	10,257	14,017	6,823	13,212	12,540	8,906	2,081	11,819	5,032	4,031	45,304	560,474

2/4/92

Table RAIL8
2020 (Adopted) PM Peak Period Transit Trips
RAIL ALTERNATIVE

Origin District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
	Destination District																											
1 N Snohomish	366	263	17	62	0	0	7	72	0	10	0	0	0	0	0	0	17	0	0	14	7	0	0	0	9	8	0	852
2 Everett	4566	3112	1436	1256	0	50	56	0	20	18	0	0	0	0	0	100	35	0	21	136	18	14	0	78	14	0	0	10,930
3 Alderwood	688	1056	1950	1155	9	22	31	270	6	9	19	6	0	3	2	0	3	0	0	8	24	0	6	0	0	30	0	5,297
4 N Creek	110	189	267	384	0	0	12	116	0	0	7	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,102
5 Shoreline	0	0	41	144	159	240	276	64	23	117	159	60	3	159	22	99	0	31	0	81	57	14	21	8	0	19	9	1,806
6 Ballard	0	14	85	24	98	908	328	232	201	324	240	120	11	144	123	22	32	35	13	84	43	17	17	25	19	56	0	3,215
7 N Seattle	0	0	72	28	228	457	427	307	75	362	304	62	7	284	96	40	13	31	31	140	16	110	48	102	6	55	6	3,307
8 U District	139	8	416	195	555	1123	1357	462	214	1150	631	223	40	647	625	288	140	418	209	950	827	368	104	579	245	395	47	12,355
9 Queen Anne	0	8	149	75	79	333	172	100	240	339	247	199	13	214	194	80	51	100	34	179	141	43	11	89	39	120	16	3,265
10 Capital Hill	24	60	394	234	354	736	715	490	508	912	549	430	42	1193	464	247	255	368	128	410	346	96	59	152	306	180	48	9,700
11 Seattle CBD	587	932	6014	3247	2944	4998	5379	1879	3598	4708	8941	3471	250	3693	3429	1974	2311	3711	1886	4335	3863	965	648	3076	1912	369	819	79,939
12 W Seattle	0	0	70	0	27	105	50	24	77	91	187	775	37	168	224	23	11	33	43	14	18	16	0	18	15	6	0	2,032
13 Duwamish	0	0	148	85	50	170	126	50	110	207	111	215	18	157	263	85	145	160	114	77	145	25	31	43	33	63	58	2,689
14 S Seattle	35	51	108	37	49	206	267	127	133	583	322	188	20	761	250	170	61	154	38	80	29	22	22	39	20	43	25	3,840
15 Sea-Tac	0	0	20	0	50	98	99	29	55	198	224	252	2	132	538	120	86	469	88	37	31	21	0	23	33	19	13	2,637
16 Renton	18	0	39	89	152	113	121	59	64	163	96	116	6	165	497	679	536	562	594	445	233	86	23	330	174	59	120	5,539
17 Kent	0	0	0	17	57	32	77	19	17	26	90	58	4	37	79	159	471	135	262	28	84	46	0	182	17	4	8	1,909
18 Federal Way	0	0	16	0	118	38	0	53	124	83	288	52	14	42	460	121	286	525	98	0	0	0	0	0	0	12	8	2,338
19 SE King County	0	0	0	0	0	0	0	18	8	22	36	12	0	0	45	258	396	157	119	0	0	0	0	0	0	0	0	1,071
20 North Shore	0	0	13	0	52	77	104	89	37	85	102	23	0	10	66	35	0	15	49	372	269	21	20	97	46	20	0	1,602
21 Redmond	0	0	28	32	66	76	61	176	16	231	208	30	0	96	17	118	47	0	0	159	248	76	0	130	214	97	0	2,126
22 Bellevue	63	0	96	0	146	80	166	105	48	103	74	58	1	46	156	234	24	47	53	610	580	107	108	652	115	0	0	3,672
23 Mercer Island	0	0	0	0	6	18	3	10	14	25	7	5	1	26	3	8	0	4	0	1	32	19	24	39	0	30	0	275
24 Eastgate	23	13	25	0	20	74	61	55	76	162	120	18	0	66	58	175	52	18	46	136	387	239	91	311	108	0	0	2,334
25 Issaquah	0	0	31	0	0	0	7	0	13	17	21	5	0	21	0	3	0	5	0	0	19	4	0	31	172	0	0	349
26 Kitsap County	4	0	0	0	0	19	17	16	1	23	4	4	0	14	0	0	0	0	0	5	18	14	5	3	12	392	23	574
27 Pierce County	0	0	10	0	0	5	0	15	0	15	8	0	10	0	0	0	10	16	0	0	0	0	0	0	0	59	12350	12,498
TOTAL	6,623	5,706	11,445	7,064	5,219	9,978	9,919	4,837	5,678	9,983	12,995	6,399	479	8,078	7,611	5,038	4,982	6,994	3,826	8,301	7,435	2,323	1,238	6,007	3,509	2,036	13,550	177,253

Table RAIL9
1990 and 2020 (Adopted) Daily Transit Attractions by Subarea and Access Market
RAIL ALTERNATIVE

Attraction Area	1990 Estimated Attractions	1990 Estimated %	2020 Estimated Attractions	2020 Estimated %	Percent Increase
1 Snohomish County					
Walk	13,500	81.0%	39,900	73.5%	+196%
Drive	3,200	19.0%	14,400	26.5%	+350%
Total	16,700	100.0%	54,200	100.0%	+225%
2 North King County					
Walk	64,400	88.9%	91,800	77.8%	+43%
Drive	8,000	11.1%	26,300	22.2%	+229%
Total	72,400	100.0%	118,100	100.0%	+63%
3 East King County					
Walk	8,100	82.6%	23,100	72.4%	+185%
Drive	1,700	17.4%	8,800	27.6%	+418%
Total	9,900	100.0%	31,900	100.0%	+222%
4 South King County					
Walk	33,600	84.8%	58,800	74.2%	+75%
Drive	6,000	15.2%	20,400	25.8%	+240%
Total	39,700	100.0%	79,200	100.0%	+99%
5 Seattle CBD					
Walk	106,400	84.3%	168,500	72.2%	+58%
Drive	19,900	15.7%	64,900	27.8%	+226%
Total	126,300	100.0%	233,300	100.0%	+85%
King County Subtotal					
Walk	**212,600**	**85.6%**	**342,200**	**74.0%**	**+61%**
Drive	**35,600**	**14.4%**	**120,400**	**26.0%**	**+238%**
Total	**248,200**	**100.0%**	**462,500**	**100.0%**	**+86%**
6 Pierce County					
Walk	15,700	81.8%	34,600	79.2%	+120%
Drive	3,500	18.2%	9,100	20.8%	+160%
Total	19,200	100.0%	43,700	100.0%	+128%
TOTAL					
Walk	**241,800**	**85.1%**	**416,600**	**74.3%**	**+72%**
Drive	**42,300**	**14.9%**	**143,800**	**25.7%**	**+240%**
GRAND TOTAL	**284,100**	**100.0%**	**560,500**	**100.0%**	**+97%**

Note:

Access market is defined at the home (production) end of the trip. Consequently, the 19,900 1990 drive-access attractions in the Seattle CBD represent trips to work and other activities in the CBD that used drive-access from home to the transit system.

Table RAIL10
1990 and 2020 (Adopted) Daily Transit Productions by Subarea and Access Market
RAIL ALTERNATIVE

Production Area	1990 Estimated Productions	1990 Estimated %	2020 Estimated Productions	2020 Estimated %	Percent Increase
1 Snohomish County					
Walk	16,500	70.6%	51,000	61.1%	+209%
Drive	6,900	29.4%	32,400	38.9%	+370%
Total	23,400	100.0%	83,400	100.0%	+256%
2 North King County					
Walk	100,700	92.9%	136,100	88.0%	+35%
Drive	7,700	7.1%	18,500	12.0%	+140%
Total	108,400	100.0%	154,600	100.0%	+43%
3 East King County					
Walk	17,100	65.0%	41,700	55.4%	+144%
Drive	9,200	35.0%	33,600	44.6%	+265%
Total	26,400	100.0%	75,300	100.0%	+185%
4 South King County					
Walk	55,800	80.7%	95,700	69.1%	+72%
Drive	13,300	19.3%	42,800	30.9%	+222%
Total	69,100	100.0%	138,500	100.0%	+100%
5 Seattle CBD					
Walk	35,900	96.7%	56,700	91.8%	+58%
Drive	1,200	3.3%	5,000	8.2%	+317%
Total	37,100	100.0%	61,700	100.0%	+66%
King County Subtotal					
Walk	**209,500**	**86.9%**	**330,200**	**76.8%**	**+58%**
Drive	**31,500**	**13.1%**	**100,000**	**23.2%**	**+217%**
Total	**241,000**	**100.0%**	**430,200**	**100.0%**	**+79%**
6 Pierce County					
Walk	15,800	80.1%	35,500	75.7%	+125%
Drive	3,900	19.9%	11,400	24.3%	+192%
Total	19,700	100.0%	46,900	100.0%	+138%
TOTAL					
Walk	**241,800**	**85.1%**	**416,600**	**74.3%**	**+72%**
Drive	**42,300**	**14.9%**	**143,800**	**25.7%**	**+240%**
GRAND TOTAL	**284,100**	**100.0%**	**560,500**	**100.0%**	**+97%**

HOUSEHOLD AND EMPLOYMENT FORECASTS

2/10/92

Table HE1
Comparative Analysis of 1985 & 2020 Households and Total Employment Forecasts at 27 District Level

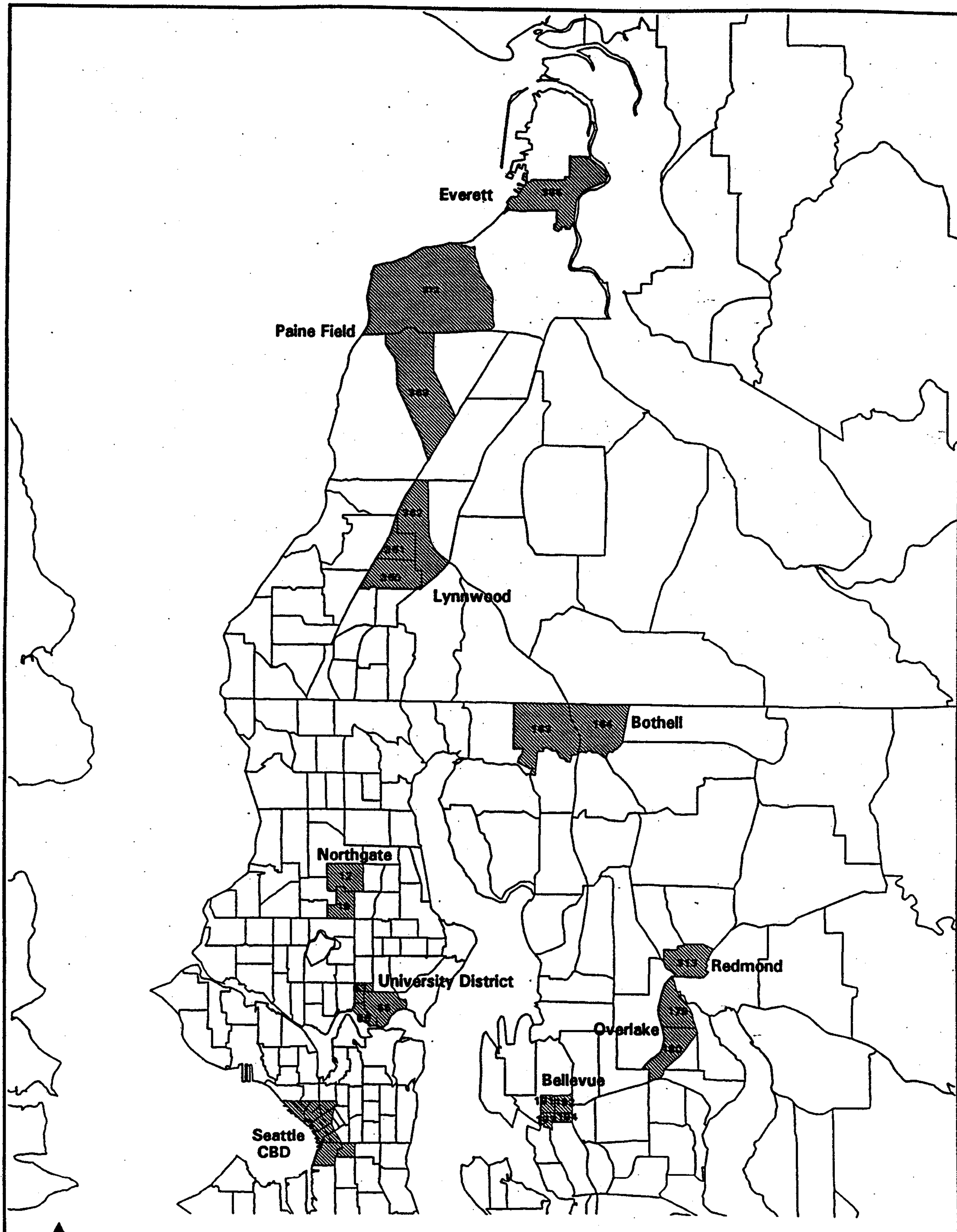
	District Name	1985	Total Household 2020 (Adopted)	Percent Increase From 1985	1985	Total Employment 2020 (Adopted)	Percent Increase From 1985
1	North Snohomish	42,291	117,132	177.0%	22,547	53,004	135.1%
2	Everett	24,054	44,541	85.2%	61,410	107,652	75.3%
3	Alderwood	45,098	99,198	120.0%	41,789	95,633	128.8%
4	North Creek	25,890	90,974	251.4%	7,217	33,261	360.9%
5	Shoreline	24,214	31,742	31.1%	20,008	29,061	45.2%
6	Ballard	46,122	55,563	20.5%	28,856	42,553	47.5%
7	North Seattle	36,591	47,504	29.8%	31,046	35,272	13.6%
8	University District	13,160	15,167	15.2%	54,294	67,893	25.0%
9	Queen Anne	27,009	30,698	13.7%	40,993	45,340	10.6%
10	Capitol Hill	38,174	43,293	13.4%	58,230	66,887	14.9%
11	Seattle CBD	8,124	12,578	54.8%	136,893	211,659	54.6%
12	West Seattle	30,417	37,373	22.9%	14,488	24,431	68.6%
13	Duwamish	4,765	3,031	-36.4%	67,704	73,208	8.1%
14	South East Seattle	29,387	35,558	21.0%	22,657	31,395	38.6%
15	Sea-Tac	46,592	62,992	35.2%	46,331	86,215	86.1%
16	Renton	29,852	55,080	84.5%	93,168	133,717	43.5%
17	Kent	26,657	57,037	114.0%	58,962	114,256	93.8%
18	Federal Way	31,745	71,178	124.2%	14,564	47,401	225.5%
19	SE King County	35,999	103,038	186.2%	13,249	38,927	193.8%
20	Northshore	35,033	71,929	105.3%	20,345	70,421	246.1%
21	Redmond	25,464	85,264	234.8%	23,796	87,536	267.9%
22	Bellevue	10,230	15,439	50.9%	31,654	69,347	119.1%
23	Mercer Island	7,816	9,734	24.5%	5,206	7,711	48.1%
24	Eastgate	30,150	53,389	77.1%	47,918	90,606	89.1%
25	Issaquah	17,066	55,346	224.3%	8,597	33,320	287.6%
26	Kitsap County	61,156	127,348	108.2%	69,737	109,422	56.9%
27	Pierce County	184,660	350,322	89.7%	212,857	346,446	62.8%
		937,716	1,782,448	90.1%	1,254,516	2,152,574	71.6%

1/28/92

Table HE2

1990 and 2020 (Adopted) Households and Total Employment by Selected Activity Centers

Major Center	Households			Employment		
	1990	2020	% Increase	1990	2020	% Increase
1 Everett	3,748	5,585	49.0%	16,173	18,302	13.2%
2 Paine Field	4,876	11,138	128.4%	43,851	58,660	33.8%
3 Lynnwood	5,111	9,001	76.1%	11,301	19,389	71.6%
4 Northgate	4,594	5,223	13.7%	5,909	6,969	17.9%
5 University Dist.	2,635	3,098	17.6%	46,927	56,827	21.1%
6 Seattle CBD	8,527	12,557	47.3%	144,684	212,278	46.7%
7 Bothell	4,356	8,502	95.2%	4,583	17,411	279.9%
8 Bellevue	702	3,091	340.3%	23,077	52,738	128.5%
9 Overlake	1,457	2,155	47.9%	3,968	5,067	27.7%
10 Redmond	694	1,373	97.8%	5,880	15,156	157.8%
11 Renton	3,279	4,242	29.4%	31,349	37,555	19.8%
12 Tukwila	2,313	4,423	91.2%	22,969	32,575	41.8%
13 SeaTac	1,521	1,972	29.7%	23,279	33,803	45.2%
14 Kent	3,230	5,580	72.8%	7,242	10,721	48.0%
15 Auburn	7,658	12,725	66.2%	19,952	28,264	41.7%
16 Federal Way	6,036	9,045	49.9%	15,785	23,474	48.7%
17 Tacoma	15,476	19,140	23.7%	58,227	76,921	32.1%
Regional Total	1,117,859	1,782,448	59.5%	1,543,570	2,152,574	39.5%



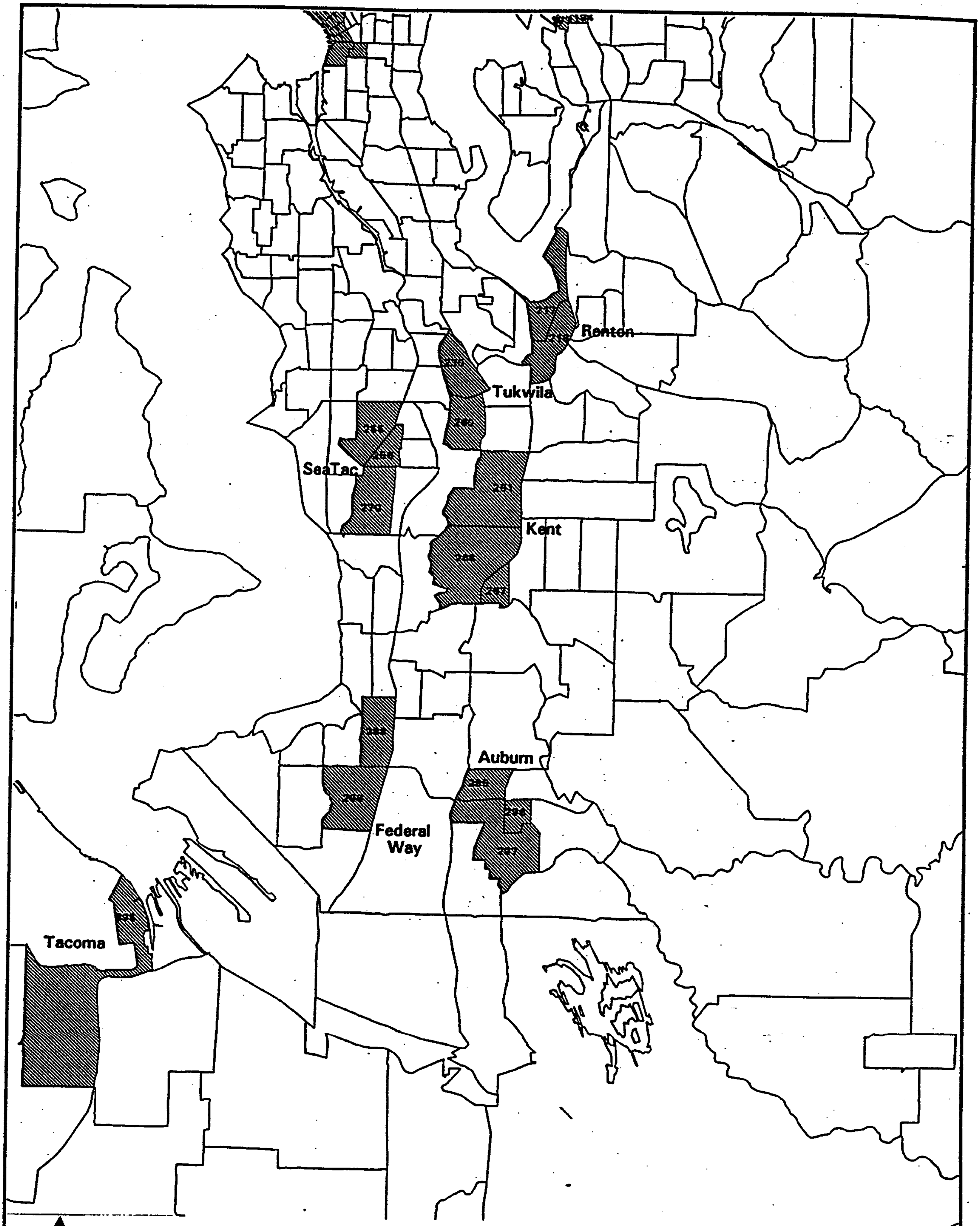
Regional
Transit
Project

KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

Definition of Activity Centers: North

System Plan EIS

FIGURE HE1



Regional Transit Project
KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

Definition of Activity Centers: South

System Plan EIS

FIGURE HE2

TECHNICAL APPENDIX D

LAND USE PLANS AND LEGISLATION

LAND USE AND TRANSPORTATION PLANS AND LEGISLATION

Under the State Growth Management Act, King, Pierce and Snohomish Counties are each charged with developing a set of countywide planning policies which will implement growth management legislation passed by the State Legislature in 1990 and 1991. These countywide policies, which are in different stages of development, are policy statements which establish a framework from which the county and municipal comprehensive plans will be developed and adopted. In addition, the counties and local municipalities are currently developing a process for how they will comply with all provisions and procedures of the countywide planning policies. These will be adopted no later than July 1, 1993 after a series of public hearings.

For the most part, local jurisdictions are still in the process of developing or amending their comprehensive plans to comply with the Growth Management Act. Most local comprehensive plans are still in the discussion stage. For this reason, this appendix does not include detailed information on local comprehensive plans or policies, with the exception of the City of Seattle's Framework Policies. However, it does examine the adopted planning policies for King and Pierce counties, as well as the proposed policies for Snohomish County. Because much of the initial portion of the Transitway/TSM or Rail/TSM Alternative is in the City of Seattle, this appendix also examines its newly adopted planning policies.

COUNTY PLANS

King County

<u>King County Growth Management Act Countywide Policies (1992)</u>

1. Urban Growth Areas and Population Distribution

Under Section II of the Countywide Policies entitled Land Use Pattern, The King County Growth Management Policy Committee or GMPC has developed a template for directing county growth over the next 20 years. Much of the growth would occur in Urban Growth Areas (UGAs), which will accommodate at least the 20-year projection of population and employment growth and provide a full range of urban services. Within the UGA, King County will identify an as yet unspecified number of Urban and Manufacturing/Industrial Centers; areas of concentrated employment and housing which would be served directly by high capacity transit. Growth will first be directed to centers and urbanized areas with existing infrastructure capacity, second to areas which can easily be provided with services, and last to areas requiring major infrastructure and service improvements. Urban separators (permanent low density lands) will protect resource lands and create corridors between urban lands.

Urban and Manufacturing/Industrial Centers. Much of the new growth would be concentrated into Urban Centers which must meet specific criteria for geographic size, number of jobs, and housing densities sufficient to support high capacity transit. Policies describe incentives to jurisdictions to establish centers and incentives for development. Manufacturing/Industrial Centers shall also meet criteria for geographic size, number of jobs, transit, truck access, and parking. Centers will be designated through a joint local-county adoption process.

Urban Growth Outside of Centers. Local jurisdictions shall designate minimum residential densities and targets for employment growth for areas outside centers and encourage infill development compatible with existing neighborhoods. Office development will be directed primarily to urban centers and the total amount of land zoned for business and office park use shall not be increased. Mixed uses shall be encouraged in existing business office parks. Targets for employment growth outside centers shall be established for cities and unincorporated urban communities though a joint local-countywide adoption process.

2. Joint City and County Planning

Cities are providers of urban services in urban areas while the county provides most countywide services. Urban services are not to be extended through special purpose districts without the approval of the affected jurisdiction. Cities should assume responsibility for provision of services now accommodated by special purpose districts. All cities should designate a potential annexation area (in coordination with adjacent jurisdictions), which shall not overlap, to ensure that unincorporated urban islands are not created between cities. Each city must adopt criteria for annexation and a schedule for providing urban services and facilities. Under some circumstances a jurisdiction may designate a potential impact area beyond its potential annexation area. As part of the designation process, the jurisdiction will establish criteria for review of development proposals under consideration by other jurisdictions in the impact area.

3. Transportation Facilities and Strategies

The land use pattern shall be supported by a balanced multi-modal transportation system (including high capacity transit, a non-motorized component and Transportation Demand Management (TDM)) cooperatively planned, financed and constructed by county jurisdictions and others. Vision 2020 provides the framework for creating a system of regional centers linked by high capacity transit and HOV, and the Puget Sound Regional Council's Transportation Improvement Program should be the primary tools for prioritizing improvements. The GMPC will develop Level of Service (LOS) standards and a concurrency system for countywide routes, policies for implementing TDM, and financing strategies. Countys and cities together with WSDOT will define LOS and concurrency, as well as a process for

implementing concurrency. Each local jurisdiction will establish mode-split goals for non-SOV travel to major employment centers. Metro is responsible for establishing transit LOS standards. Each jurisdiction shall identify facilities necessary to coincide with target service levels and timing requirements.

4. Contiguous and Orderly Development of Urban Services

An integral part of the phasing of development is ensuring that development is accompanied by a full range of urban services. The framework policies promote the coordinated planning and financing of services to promote the public health, environment, and the implementation of the countywide vision and land development pattern. Jurisdictions will identify necessary services and timelines, and balance conservation of natural resources with the provision of necessary services.

5. Siting of Public Capital Facilities

Capital Facilities shall be sited to support land use pattern and economic activities while mitigating any negative impacts. The Growth Management Planning Committee will establish a process for cooperatively siting capital facilities, including facility definition, inventory of existing facilities and needs, incentives to host jurisdictions, selection of coordinating agency, public involvement, protection of the environment and public health/safety, and consideration of alternatives to the facility.

6. Conformance of the RTP System Plan Alternatives with King County Countywide Planning Policies

Both the Transitway/TSM and the Rail/TSM Alternative would connect the region's major urban and manufacturing centers with fast, efficient service while expanded and restructured bus service would bring people from neighborhoods into the centers. The TSM Alternative would provide somewhat less efficient connections. The No-Build Alternative would not be consistent with the county policies.

All three build alternatives include the following called for in the Countywide Policies:

- o Expanded transit service between residential areas and the centers
- o Interconnected system of Diamond Lanes
- o Facilities for bikes and pedestrians
- o Programs which support use of transit and ridesharing

Both the Transitway/TSM and Rail/TSM Alternative provide high capacity transit lines linking the major activity centers. However, the Rail/TSM Alternative

provides a much more extensive network than the Transitway/TSM Alternative. Unlike the Rail/TSM Alternative, neither the TSM and Transitway/TSM alternatives do not provide the level of transportation capacity in already congested corridors and centers necessary to accommodate projected transit demand.

Under all three build alternatives, the system would be implemented incrementally to serve both immediate and long term needs. Transit levels of service will be established to help planners anticipate levels of transit service in their communities. Bus service would be expanded and restructured, along with phased rail system development would allow the transit system to support local land use actions and help shape new growth patterns.

The capital improvements associated with the three build alternatives would be sited to support the preferred land use pattern and proceed in accordance with the process established by the GMPC. The Rail/TSM Alternative would involve the most extensive siting and development process of the three build alternatives while providing a high level of investment in a number of centers.

King County Comprehensive Plan (1985). The King County Comprehensive Plan is the County's long-range, county-wide comprehensive land use Plan. The County's land use authority is exercised in the unincorporated territory of King County; the incorporated cities and towns have independent authority over land use within their boundaries, and in many cases also have major influence over unincorporated areas adjacent to their boundaries. The Comprehensive Plan sets general land use and transportation policies, while area-specific policies are set by the subarea plans, as detailed below.

The Plan encourages new residential development in Urban Areas. The primary locations for commercial and industrial development are Urban Activity Centers, which should be in areas which can be cost-effectively served by transit.

Transportation policies provide for minimization of environmental impact and encouragement of energy-efficient facilities such as buses and HOV lanes. Transit service should reinforce growth in Urban Areas. Transit centers should be located in Urban Activity Centers, and should include safe and convenient pedestrian and bicycle access. Transit service in Rural Areas should emphasize local service for transit-dependent residents rather than commuter service, which should be provided by park-and-ride lots in Urban and Transitional Areas.

The King County Transportation Plan (1987), amended in 1988, updates and expands on the transportation policies in the 1985 Comprehensive Plan. In general, the Plan recommends increased peak hour and midday transit service on existing routes, new transit service in developing areas, and a number of new park-and-ride lots in urbanizing areas. The Transportation Plan also provides specific policies for encouraging transit ridership and making transit/ridesharing road improvements.

The County is also working on an arterial HOV Plan which will identify HOV improvements on local arterials and which would be consistent with the general thrust of the TSM elements in the System Plan. The 1988 amendments to the plan support immediate planning for high capacity transit rail implementation, including providing access routes, completing the regional HOV system, developing an arterial HOV system, preserving high capacity transit right-of-way, and amending the Comprehensive Plan to establish land use and densities to support high capacity transit. The amendments also adopted the recommended transit service concept of the Eastside Transportation Program (see below), including providing more direct transit connections among Eastside activity centers.

The three build alternatives for the System Plan are consistent with the general policies in the Comprehensive and Transportation Plans. All three encourage energy-efficient facilities and are being designed to minimize environmental impact. Service is oriented to Urban Areas and transit centers would be located in Urban Activity Centers and provide good pedestrian and bicycle access. However, the 1988 amendments to the Transportation Plan clearly emphasize implementation of a rapid transit system, which would be best supported by the Rail/TSM Alternative and, to a lesser degree, by the Transitway/TSM Alternative.

Subarea Plans. The three build alternatives for the System Plan all include TSM elements which would be constructed in portions of unincorporated King County. In addition, portions of the Rail/TSM Alternative would be constructed in unincorporated King County. Subareas of King County affected by construction under the build alternatives include East Sammamish, the unincorporated portion of the Federal Way subarea, Highline, Newcastle, Northshore, Shoreline, Snoqualmie Valley, and Soos Creek.

The *East Sammamish Community Plan and Area Zoning (1982)* provides land use and transportation policies for the area east of Lake Sammamish and west of the Snoqualmie River valley between State Route 202 and I-90. The Plan calls for expanded transit service within the community and to other destinations and creation of new park-and-ride or park-and-pool lots. It provides for establishing densities, circulation patterns, and transit improvements which would support transit service in new master planned developments in the area. The Plan is currently being updated to include the need for more aggressive actions for transit on the Sammamish Plateau. Expansion of service under the three build alternatives would be consistent with the Plan, as would provision of rapid transit connections in the I-90 corridor under the Rail/TSM Alternative. A potential rail station in the area on the Burlington Northern Railroad just north of Issaquah and I-90 would be supported by the designation of that area as Manufacturing Park.

The *Federal Way Community Plan (1975)* and the *Federal Way Revised Community Plan Area Zoning (1980)* provide land use and transportation policies for the area between the incorporated city of Federal Way and the Green River Valley. The

Plan is supportive of additional local transit service and inter-community connections, integration with a rapid transit system, new park-and-ride lots (which have been implemented since adoption of the plan), and acquisition of rights-of-way for transit. The Plan is thus supportive of the service concept represented by the three build alternatives and of service by a rapid transit system, as represented by the Rail and Transitway/TSM Alternatives.

The *Highline Community Plan (1977)* provides land use and transportation policies for the area of unincorporated King County south of Seattle and north of Federal Way between Puget Sound and I-5. The *Burien Activity Center Update and Area Zoning (1991)* updates those portions of the Highline Plan pertaining to Burien. The Highline plan calls for improved transit connections within and to destinations outside the subarea, integration of the bus system with other modes of transportation, transit-friendly street improvements, express stops along I-5, SR-509, and SR-518, extended transit operating hours and increased transit frequencies, and new park-and-ride lots. Some of the specific improvements recommended by the Plan have been implemented since its adoption. The Burien Plan provides for integration of transit and high-capacity transit with road improvement projects, easy transfers between transit and other modes, and moving the Burien park-and-ride to a peripheral location in the Burien Activity Center. The Plan expresses a desire that Burien be included in planning for a rail system. The service improvements planned under the three build alternatives would be consistent with the Plan's provisions for improved connections and increased service in the area. The Rail/TSM link from Burien to the main Seattle-Tacoma line would be consistent with the Burien Plan's encouragement of rapid transit. However, if the Burien Transit Center is expanded in its current location, it would be inconsistent with the Plan's provisions for relocating the transit center to the periphery of the Burien Activity Center.

The *Newcastle Community Plan (1983)* provides land use and transportation policies for the area between I-405 and Issaquah south of Bellevue and north of the Cedar River. The Plan gives a high priority to HOV lanes and expanded transit service within and to destinations outside the subarea and at nonpeak hours. It also provides for new park-and-rides at Factoria and in areas where densities will not support bus routes. The TSM service and capital elements under the three build alternatives are consistent with this Plan. Potential provision of service by rail, transitway, or express bus to other parts of the region would also be consistent with the general thrust of the Plan. A possible rail station at Factoria would be consistent with the Plan, and a potential rail station or park-and-ride at Lakemont Boulevard and I-90, while not specified in the Plan, would be supported to some extent by the areas designated as multifamily at that location.

The proposed *Northshore Community Plan Update and Area Zoning (1991)* provides land use and transportation policies for the area of King County east of Lake Washington and north of Kirkland and Redmond. The Plan calls for channeling much of the new growth into current activity centers, aggressive transit and TDM

measures for SR-522 west of Bothell, encouraging commuters to use public transit, establishing a link between new development and transit service, increasing service frequency and connections with the Eastside, establishing transit centers in Bothell, Kenmore, and Woodinville, new park-and-ride lots in Kenmore, North and South Woodinville, expanded park-and-ride lots in Bothell, Brickyard Road, Kenmore, and Kingsgate, support for high capacity transit's land use and infrastructure needs, and HOV lanes on I-405 and SR-522, as well as several arterials. Both the TSM proposals under the three build alternatives and the provision of rapid transit under the Transitway/TSM and Rail/TSM Alternatives are consistent with the subarea plan. The No-Build Alternative is inconsistent with the subarea plan.

The *Shoreline Community Plan and Area Zoning (1980)* provides land use and transportation policies for the area of King County directly north of Seattle. It calls for enhanced access to transit for the transit-dependent population, improved transit service within and to destinations outside Shoreline, and coordination of transit with other modes of transportation. All three build alternatives, unlike the No-Build Alternative, would be consistent with the transit provisions of the Plan. Park-and-ride expansions would also be consistent with King County's policies for park-and-ride siting. The Aurora Village transit center expansion would be consistent with designation of that area as Community Business. However, to the extent that station on I-5 at NE 175th and NE 145th would increase pressure for development, the Rail/TSM Alternative is inconsistent with the designations of those areas as low density single-family.

The *Snoqualmie Valley Community Plan and Area Zoning (1989)* provides land use and transportation policies for the area of King County east of the Sammamish Plateau and west of the Mount Baker-Snoqualmie National Forest. The Plan calls for improved public transit service between rural activity centers and other suburban cities and development of park-and-ride and park-and-pool lots in rural activity centers and near freeway interchanges. Because this area is beyond the King County urban growth boundary, there would be very little increased transit service to this area under any of the alternatives, which would be inconsistent with the improvement of transit service called for in the Plan. The expansion of the park-and-ride lot at Preston under the three build alternatives would be consistent with the Plan.

The *Soos Creek Community Plan Update and Area Zoning (1991)* provides land use and transportation policies for the area of King County between the Cedar and Green Rivers, east of Auburn and Kent and west of the Tahoma Raven Heights subarea. The Plan calls for increased bus service frequency, extension of routes, establishment of new routes in developed portions of the subarea between the Green River Valley and the plateau, in the Benson Road corridor, in the Covington area, and to the Green River Community College, as well as improving transit and paratransit connections to Green River valley employment centers and eastside cities. The Plan calls for a number of new east-west arterials that would incorporate

transit and HOV improvements and for new park-and-ride lots in Covington, Soos Creek/Panther Lake, and East Kent. The increased transit service provided under the three build alternatives would be consistent with the Plan's emphasis, although provision of new park-and-ride lots would be limited in comparison to those called for by the Plan.

Pierce County

Pierce County has adopted county-wide planning policies in accordance with the 1991 GMA amendment. County-wide planning policies are policy statements which establish a framework from which the county and municipal comprehensive plans are developed and adopted. The framework is intended to ensure that county and municipal plans are consistent. Five of the eight required county-wide planning policy elements are particularly relevant to the Regional Transit Project. A summary of the policies and the consistency of the regional transit plan with them follows.

<u>Designation of Urban Growth Areas and Distribution of 20-year Population Forecasts</u> - The Urban Growth Areas (UGAs), accommodating only 20 years' growth are to be determined through a synthesis of city-designated municipal UGAs and county-designated county UGAs. Following an agreement between county and municipalities the UGA boundary designation will be transmitted to municipalities for adoption. The UGAs' size and boundaries will be based on: the preservation of resource/environmentally sensitive lands and open spaces; new, fully contained communities (FCCs) consistent with the centers concept of Vision 2020; adequate provision of services; sufficient supply of developable land; existing projects/development; land features; availability public services and facilities; and jurisdictional boundaries and designations. The county and cities will designate tiers within UGA to direct growth based on services and facilities to: "primary growth area" (accommodating 6 years' development), "secondary" (7 to 13 years) and tertiary (14-20 years) growth areas. UGAs may be amended through the same process with which they were adopted.

The Regional Transit Plan supports this policy through the JRPC's adopted goals of preserving communities and open space and preserving environmental quality.

<u>Joint County and City Planning within Urban Growth Areas</u> - Prior to annexation UGAs outside of cities will be subject to joint city-county planning resolving: the development review process, the source of LOS designations, the process of providing capital improvements, annexation rate and timing, and to what extent cities may exercise extrajurisdictional responsibilities prior to annexation. Urban government services shall be provided primarily by the cities.

The Regional Transit Plan supports this policy through the JRPC's adopted goals of preserving communities and open space and preserving environmental quality.

Countywide Transportation Facilities and Strategies - The county and cities will coordinate LOS designations for roadways, intersections and transit, understanding that such determinations will affect growth (i.e. the investment needed to satisfy concurrency requirements). The county and cities will monitor the adequacy of the system and address deficiencies by prioritizing improvements for funding, using TDM and/or TSM. Compatibility between land use and transportation will be achieved through requiring 20-year phasing of transportation improvements (consistent with tiers), restricting improvements outside of UGAs and using land use regulations to improve modal split. The county and cities will address the environmental impact of policies and energy conservation and encourage efficient use of the transportation system through structural and non-structural improvements.

The Regional Transit Plan alternatives support the transportation element with the following capital improvements and programs:

- connecting activity centers with rapid transit;
- connecting residential areas with activity centers with expanded transit service;
- investing in facilities for pedestrians and bicycles;
- promoting the completion of the HOV lanes; and
- promoting programs that reduce travel demand and encourage people to use transit and ridesharing.

Promotion of Contiguous and Orderly Development and Provision of Urban Services to Such Development - Development must be timed with all necessary facilities and services, i.e. supporting transportation facilities must be funded at time of development and implemented within six years, and all other services must be in place at the time demand is created (or a funding source must be identified), as consistent with applicable level of service standards. Ensure that development isd directed first to areas with existing supporting public facilities and service. Each jurisdiction is to establish adequacy/LOS standards for services provided by that governmental entity, or interlocallu where jurisdiction lines are crossed. Facilities extended for new development will be funded through development fees and are subject to impact considerations.

While not specifically addressed in the RTP, RTP staff are working with other jurisdictions to help establish levels of transit service that will support the pattern of land use desired by the jurisdictions.

Siting of Public Capital Facilities of a Countywide or Statewide Nature - The county and municipalities will adopt a policy and process for siting public capital facilities. The policies must be based on facility requirements and impacts on surrounding areas. Such policies must be compatible with the countywide policy plan, the county

and municipal comprehensive plans and the goals of the GMA. The policies may also require state justification of proposed facility location (based on need and service area) and development of criteria related to facility operation and maintenance.

Siting rapid transit alignments and related facilities such as stations, transit centers, maintenece bases and storgae yords will help reinforce the devlopment of centers in accordance with the policies for growth established by the jurisdicitons.

The Transportation Plan serves as a base for the Pierce County Comprehensive Plan *(1992)*. The Transportation Plan contains a Policy Document to provide a framework for future transportation planning and decision making. The policy document contains policies grouped into four major subareas: Coordination; Standards and Capacity; Land Use and Transportation Planning; and Finance and Prioritization.

The objectives of the Coordination policies are to balance competing demands of different modes and facilitate transfers between different travel modes and effective coordination among the agencies that fund, build and operate the transportation system. The policies are divided into two areas, coordinating regional transportation planning and coordinating provision of facilities and services.

Coordinating regional transportation policies address issues such as:

- Interagency planning coordination
- Planning for airports and ferry service
- Regional coordination in planning for high capacity transit
- Coordinated planning for non-motorized travel modes.

Coordinating provision of facilities and services focuses on issues related to specific projects, and connections between travel modes, including:

- Coordination in the review of capital improvement programs, and specific project designs
- Coordination in the construction of projects
- Facilitation of transfers between different travel modes
- Improvements to rail services
- Provision of transit service throughout the county.

The Standards and Capacity policies guide the design, construction, operation, and maintenance of the county's transportation system so that it will operate safely and meet the demands of users.

The Land Use and Transportation Planning policies are intended to guide the county transportation system toward better serving existing and future development. The Design Guidelines for Land Development policies encourage:

- o Providing for transit access to and within developments.
- o Providing for pedestrians and other non-motorized transport.
- o Controlling access to and from arterials.
- o Coordinating access for developing areas along roadways.

The Right-of-Way policies address the county's need to have an adequate transportation system in the future. The policies provide for the identification, acquisition and preservation of rights-of-way for future transportation needs, and linking land development to the provision of an adequate transportation system.

The Compatibility of Transportation with Land Use policies address:

- o Protecting residential areas from the impacts of major roadways
- o Providing for compatible land use near airports
- o Locating and designing park-and-ride lots
- o Locating and designing transit centers.

The Finance and Prioritization policies have two objectives, to secure adequate funding to finance the county's transportation needs and to establish a consistent and equitable method for allocating the county's funds.

Pierce Transit. The Interim Pierce Transit System Plan (1992) sets out two overall goals: to provide a framework for developing and evaluating public transportation services and facilities over the next 20 to 30 years; and to identify system options and components for inclusion in the RTP System Plan. Specific objectives to be addressed under the framework for long-term development are:

- o To identify the environemtn for transit development within Pierce County as well as within the Puget SOund region; this environemnt involves both short term developments as well as longer term policy changes associated with the Vision 2020 policy direction;

- o To recommend appropriate strategies that will address both short and long term travel needs fro Pierce Transits' service area; the strategies will be based on an assessment of expected overall growth forecasts, travel patterns and land use characteristics; and

- o To identify and assess system development options that will address the emerging environment for transit; development options will involve necessary service expansion and supporting facilities to meet future market needs.

Snohomish County

Snohomish County Tomorrow County-Wide Planning Policies
Countywide Planning Policies for Snohomish County

The Snohomish County Planning Policy document is currently under review. The policies include a range of framework policies intended to guide the county's comprehensive planning process. The following description is subject to revision following further countywide review.

1) Urban Growth Areas and Population Distribution

Snohomish County plans to establish urban growth areas (UGAs) by October of 1993 that accommodate at least 20 year population projection, are based on plans for the preservation of existing development and infill strategies, can be supported by urban services, do not infringe on resource lands, and include designated open space within UGA boundaries and on the periphery to provide separation. After determining the extent to which UGAs help to redirect growth from rural to urban areas, Snohomish County would allocate final growth projections through a cooperative planning process with Snohomish County Tomorrow (SCT). The County will establish a mechanism to monitor the effectiveness of boundaries annually, with comprehensive review at least every five years. New fully contained or master planned communities (MPCs) will be considered only if the UGAs cannot accommodate 20-year forecast.

Centers within the UGAs will be established according to a hierarchy consistent with Vision 2020 and which reinforces efficient transportation and infrastructure planning. These centers would have clearly defined geographic boundaries. Growth would be accommodated first in larger centers where higher density residential and employment concentrations will be encouraged. Areas within urban growth boundaries which are designated for multi-family and non residential development will be characterized by mixed use, pedestrian friendly and transit compatible development. Although not officially designated at this time, Metropolitan and Subregional Centers would be located along planned rapid transit routes.

2) Joint County and City Planning Within UGAs

The County will establish an interjurisdictional process to prepare consistent growth management plans and establish groups of elected and appointed officials, citizens and/or staff to review plans prior to final action of the city or county planning commissions; Snohomish County Tomorrow (SCT) shall review plans to determine consistency of plans with each other and within framework and countywide policies.

An approved countywide transportation plan will establish the basic framework for city and county transportation plans. Core transportation goals include development of a multi-modal system; reduced reliance on single-occupancy vehicles, and increased availability and use of high occupancy vehicles and lanes. Draft policies for transportation include designation of transportation service areas to provide a geographic basis for joint projects, provision of public transportation services appropriate to designated types and intensities of land use; development of consistent transportation design standards for all modes of transportation; use of TDM to reduce trip making; consistent LOS determination methods, compatibility with land use elements, and development of uniform criteria for locating and mitigating the impact of major county-wide and regional transportation facilities and services including high capacity transit facilities.

4) Contiguous and Orderly Development

The County will develop plans to ensure the provision of necessary public facilities and services for new development at time of occupancy, within and outside of UGAs. Infill and development will be promoted where services already exist, and urban infrastructure will be extended only within UGAs. Development within unincorporated portions of UGAs will be prohibited until services are available. Compatible infrastructure construction standards will be developed for all UGAs.

5) Siting of Capital Facilities

Policies for the siting of regional public capital facilities include the establishment of an interjurisdictional planning process to include a common site review process (including consideration of alternatives), built upon existing processes such as SEPA, and based and the development of common site evaluation criteria which do not preclude the siting of essential public facilities in any jurisdiction.

6) Conformance of System Plan Alternatives with Planning Policies

Thus far, the framework policies are supportive of the RTP in terms of goals and objectives. Both support the Vision 2020 goals which call for maintaining regional mobility via creation of a comprehensive multi-modal system consisting of rapid transit, expanded transit service, completion of the HOV system, and reduced reliance on single-occupancy vehicles. Both sets of policies support the concentration of growth in designated mixed use regional centers served by rapid transit. Given that the Snohomish Framework policies are still in the process of countywide review, any detailed evaluation for consistency with the RTP System Plan Alternatives would be subject to change. Once the polices have been formally adopted, they will be reviewed accordingly.

The Snohomish County Comprehensive Plan consists of thirteen subarea plans which together constitute the comprehensive plan for the County.

The *Snohomish County Tomorrow Plan* (1990) consists of a set of unofficial goals which were compiled to guide future planning within the County. The plan cites the need to reduce reliance on the single occupant vehicle as a mode of transportation and increase reliance on high occupancy vehicle modes of transportation.

Snohomish County has also adopted transportation system management and transportation demand management measures as a part of its Traffic Mitigation Ordinance and has formally endorsed the Transportation and Land Use Guidelines which were published by the Snohomish County Transportation Authority.

The *North Creek Area Comprehensive Plan (1986)* is the only sub-area plan which explicitly acknowledges the high capacity transit corridor and a potential station site. The North Creek plan covers the area between I-5 and the Snohomish-Snoqualmie valleys. A limited 1990 amendment, which focuses exclusively on the southeast quadrant of the I-5/128th Street interchange, requires that the review of proposed new developments in the area take into account the likelihood of the I-5 corridor ultimately accommodating a high capacity transit system.

The North Creek Plan includes various transit-supportive policies, including encouraging the development of multifamily housing close to public transportation corridors and linking major commercial developments to existing and planned public transportation services.

The *Paine Field Area Comprehensive Plan (1983)* focuses on the subarea with the largest concentration of population and employment within the County. The area is also the fastest growing area and is expected to accommodate the greatest future growth. The Plan includes the most focused growth management and public transit policies of any of the thirteen County subareas, including focusing new urban growth and encouraging higher density housing within identified urban areas. The plan also includes a variety of transportation policies which are supportive of more effective transit service.

Although there is some limited acknowledgment of the likelihood of future high capacity transit service and stations within the county, there currently is no specific policy endorsement or support of future high capacity transit service on the part of Snohomish County. Existing County policy is generally supportive of transportation system management and demand management measures. Hence, the build alternatives are generally consistent with adopted County policy. The No-Build Alternative is the least consistent alternative.

Snohomish County Transportation Authority (SNO-TRAN). The Snohomish County Transportation Authority is responsible for long range county-wide public

transportation planning within Snohomish County. Community Transit and Everett Transit are responsible for short-term and mid-term operations planning necessary for provision of their transit services; Everett Transit provides service within Everett and Community Transit provides suburban and intercounty service. SNO-TRAN is the designated lead agency for liaison and coordination with regard to the Regional Transit Project within Snohomish County.

Planning for high capacity transit within Snohomish County has always included a rail or express bus line that would connect between Everett and Seattle. In 1986, with the concurrence of all the affected Snohomish County jurisdictions, SNO-TRAN adopted the concept of a Snohomish County segment of a regional rail system and specified that the segment would lie along the I-5 corridor between the County line and downtown Everett.

Snohomish County, the City of Everett, and seven other local jurisdictions have adopted an intergovernmental agreement relating to the reservation of right-of-way and associated land for a high capacity transit system within the I-5 corridor. The agreement asks each jurisdiction to reconfirm its commitment to development of the regional rail system; incorporate the HCT project and corridor in its comprehensive and transportation planning, and adopt policies that encourage future development that is compatible with and supports high capacity transit, and seek to maintain or improve access to planned stations.

As a part of the interjurisdictional high capacity transit planning program, a series of local station area studies have been completed which identify possible station areas along the I-5 corridor. The studies are intended to assist local officials in understanding station location alternatives, potential station impacts, and a range of land use, traffic, environmental and community policy issues that could affect the capacity of potential stations to both operate effectively as components of a regional high capacity transit system and serve community goals. Station area studies have been completed for Mountlake Terrace, Lynnwood, unincorporated Snohomish County and Everett.

Public Transportation Plan for Snohomish County (1989). The SNO-TRAN Public Transportation Plan (PTP) for Snohomish County is intended to provide long-range guidance for the development of public transportation services and facilities and create an environment within the county to support the efficient and effective operation of public transportation services, including integration of local transit with a regional high capacity transit system. The Plan emphasizes the need for substantial changes to land use patterns, local road networks, and the local transit system if high capacity transit is to be effective.

The SNO-TRAN Public Transportation Plan presents a conceptual overview of a desirable regional public transportation system and the land use pattern and transportation network that would support it. The system would include passenger

rail service between Everett and Seattle; express and commuter bus service to and from the eastern portions of Snohomish County and major employment centers within King and Snohomish Counties; feeder buses serving rail and express bus stations; an expanded system of HOV facilities, including HOV lanes along freeways and some arterial roadways, busways, park-and-ride lots, and preferential signals and turning lanes for buses; customized services for individual markets; special mini-bus, van, and taxi services for populations with significant mobility limitation; custom buses, vanpools, and carpools with ride-matching programs; and express, feeder and local bus service coordinated with ferry service. The Plan also envisions expanded use of transportation demand management and transportation system management techniques to reduce reliance on single occupant vehicles and coordinated land use, economic development, and transportation policies.

The Rail/TSM and Transitway/TSM alternatives are most consistent with the integrated public transportation system envisioned in the Public Transportation Plan. The TSM Alternative, while supportive of the Plan, is less consistent in that does not provide for high capacity transit. The No-Build Alternative is inconsistent with the plan's objectives.

SNO-TRAN also produced *A Guide to Land Use and Public Transportation for Snohomish County (1989)* which provides an introduction to the concept of transit-compatible land uses and is intended to assist Snohomish County communities in enhancing future mobility options.

Community Transit. *Community Transit's Comprehensive Plan 2001 (1989)* examines a range of service alternatives, including a continuation of existing service levels, maintenance of market share, and expansion of market share. The plan cites the need to expand park-and-ride facilities and HOV facilities, and institute major supportive actions by local governments in order to expand market share. Integration of Community Transit's future service plans with the regional transit project will require coordination of service plans with regional feeder bus service and regional intercounty high capacity transit service.

Local Plans

Because the City of Seattle includes portions of both the North and South Corridors of the Regional Transit Project, consistency with its comprehensive plan is discussed separately from the discussions of the three corridors.

Seattle

City of Seattle Comprehensive Plan Framework Policies (June 1992)

In accordance with the Growth Management Act, the City of Seattle Comprehensive Plan Framework policies have been drafted to guide the development of the City's comprehensive planning effort. The policies address a number of important issues including the City's role in the region, environmental stewardship, neighborhood identity, transportation and the location of public facilities. Policies relevant to the Regional Transit Project System Plan have been summarized under the following headings.

Regional land use policies
Local land use planning issues
Transportation
Location of public facilities

Regional Land Use Policies

The Framework policies support the regional land use strategy which calls for the concentration of growth in a limited number of urban centers including Seattle and changes in zoning to discourage growth in areas not easily served by existing transportation facilities to promote the development of an efficient and effective regional transportation system. The City proposes to support regional growth management goals by absorbing a larger share of the projected growth than is currently allocated to the city under existing policies.

Local Land Use Planning Issues

This growth shall be accommodated, in part, within Urban Villages; existing and new neighborhoods throughout the city characterized by mixed use or adjacent commercial and residential uses which lend themselves to neighborhood ownership, have moderate to high densities, good transportation access and a pedestrian supportive environment.

In addition, particular emphasis is placed on encouraging growth within walking distance of downtown employment and high capacity transit centers. The city supports the establishment of new high density residential environments in areas adjacent to the downtown such as the Denny Regrade, First Hill, Pike and Pine Streets, and the Cascade neighborhood and in existing activity centers which have easy access to the regional transit system. Criteria for selection of these high density villages might include; relationship to the regional transit system and the overall transportation network that provides convenient access to numerous destinations as well as the availability of services and amenities within the neighborhood.

Transportation

The region's transportation system is seen as the single most important determinant whether the city can achieve these other policies. The city supports the development of a multi-modal system with greatly expanded transit capacity, high occupancy vehicle improvements, and non-motorized facilities. Balancing the need for convenient and safe access to jobs and services with environmentally sound practices both within the City and throughout the region is seen as a primary challenge.

Part of this challenge could be met by developing neighborhoods which are less dependant on the single-occupancy vehicle. Urban Villages; pedestrian oriented, mixed use neighborhoods which are developed at adequate densities to support high levels of transit service will make alternative modes of travel more convenient. This would include accelerating the development of bicycle and pedestrian facilities. Station areas supporting a regional high capacity system would be good candidates for urban villages.

The City will establish mode-split goals for non single-occupant-vehicle travel to all significant employment centers within the City. The City shall also establish arterial level of service (LOS) standards which reflect different objectives depending on the use of the street and the needs of the neighborhood it serves. Improvements will be directed toward increasing the capacity of a given arterial for non single occupancy travel, including non-motorized travel. The City shall establish transit mode-split goals and transit level of service standards with the goal of making transit the primary mode of travel between downtown and the major activity centers. Neighborhood to neighborhood service will be a priority.

In addition to a transit supportive and pedestrian oriented neighborhood development program, travel demand management (TDM), parking controls and the establishment of commuter trip reduction (CTR) performance standards are seen as appropriate transportation system management strategies for reducing dependance on the single-occupancy vehicle.

Finally, the city supports the location of Regional Transit Project routes and stations in alignments that connect areas targeted for high commercial and residential densities and areas with large transit dependant populations.

Siting of Public Facilities

Growth within the City of Seattle will likely necessitate the development of a number of new public facilities, including transportation facilities, to ensure growth is accommodated in a timely and cost effective manner. Negative impacts on surrounding neighborhoods will not only be addressed, but the City will actively seek to develop positive relationships with affected communities.

Consistency with Regional Transit Project System Plan (Alternatives)

The City of Seattle's Framework Policies support the development of a regional transportation system encompassing greatly expanded transit capacity, high-occupancy vehicle improvements on highways and arterials, bicycle facilities, and pedestrian oriented neighborhoods. This recommended transportation system is envisioned as a means of concentrating growth in Seattle by emphasizing service to pedestrian oriented, mixed use, medium and high density urban neighborhoods and is consistent with the proposed Regional Transit Project System Plan.

The Relationship between RTP Service Orientation and Local Land Use Objectives

The TSM Alternative would increase transit service hours by nearly 60 percent over the No-Build Alternative. Service would include 15 minute frequency during most of the primary routes within the dense urban areas of Seattle and minimum 30 minute frequency on secondary urban routes and primary suburban routes.

The Transitway/TSM Alternative would maintain the frequencies above but adds exclusive guideways for buses and carpools to the basic TSM Alternaitve. In contrast to rail vehicles, buses can leave guideways and travel to off-line stations and through neighborhoods, minimizing transfers between feeder service and the regional system. The exclusive transit way would primarily link centers (including some potential urban villages) along I-5 to the north and south and follow I-90 east to connect Bellevue.

Under the Rail/TSM Alternative preferred alignment, the City's densest neighborhoods and those with large transit dependant populations would be served directly by rail. The Seattle CBD, First Hill, Capitol Hill and the University District in the north corridor and the Rainier Valley to the south would have frequent all day service.

Growth and Transit Ridership

The City of Seattle hopes to attract a greater share of growth to the City over the next 20 years. Making sure people can move into and within the city will be critical to attracting and accommodating this growth. The No-Build Alternative provides no increase in existing bus service over the next twenty years but fails to offer significant increases in mobility. Under this alternative, future transit ridership is expected to reach 109.4 million annual trips. Transit ridership for TSM and Transitway/TSM Alternatives is projected to reach 133.7 and 135.4 million respectively. These increases represent a 22 and 24 percent increase over the No-Build Alternative. Under the Rail/TSM Alternative, 2020 annual ridership is expected to reach 157.3 million annual trips, a 44 percent increase over what might be expected with the No-Build.

The City's Framework Policies call for a larger share of transit work trips (mode split) between activity centers. For the University District, one of the seventeen transit activity centers selected for the purpose of evaluation, existing transit work trip shares account for 23.1 percent of the trips. Under the No-build alternative, the transit share drops to 22.3 percent, reflecting the slower service and the increasingly congested environment. Under the TSM and Transitway/TSM Alternative it increases to 29.6 percent and 28.4 percent respectively, and under the Rail/TSM Alternative it increases to 34.1 percent.

In the Seattle CBD, transit currently attracts 37.7 percent of the work trips. Under the No-Build, TSM and Transitway/TSM Alternatives these percentages are 35.7, 36.3 and 35.6 respectively. Under the Rail/TSM Alternative approximately half, 46.6 percent of the work trips to the Seattle CBD would be carried on transit.

All three build alternatives would expand existing capacity and provide a network of frequent service between neighborhoods and to, between and within the City's activity centers, (many of which have been tentatively identified as potential urban villages). However, under the TSM and Transitway/TSM Alternatives the expanded capacity would still fall short of the projected demand in key centers and within key corridors.

Community Development Objectives

All three build alternatives have a baseline of TSM improvements which would include improvements to increase the speed, reliability and comfort of transit service on existing City streets. In Transit Corridors targeted for high frequency bus service, additional funding would be available for planning and developing pedestrian oriented and passenger access improvements. Where two major transit corridors cross, transit service would be focused (community transit hubs) to support commercial areas. The Rail/TSM Alternative which would include up to 20 potential rail stations within the City of Seattle would provide the most significant opportunity to focus medium and high density development and reinforce the Urban Village concept. The Joint Regional Policy Committee is committed to working with the City and communities to site and design transit centers and stations. Pedestrian and bicycle improvements could be developed within one-quarter to one-half mile of the station in order to better integrate the facility with the local community.

The *City of Seattle Comprehensive Plan* consists of an extended list of plans and policy documents, the majority of which predate consideration of regional rapid transit planning. However, a number of resolutions have been adopted within the last few years which provide some policy guidance with respect to rapid transit plans.

The recently published *Draft Framework Policies - Seattle's Comprehensive Plan (1991)* outlines basic policy options with respect to a number of critical issues. One of these is "urban character," including the location of new development. The options discussed range from maintaining existing zoning patterns and urban character to designating activity centers for focused accommodation of new growth. The designated activity center option envisions concentrating new growth in designated high-density, mixed use environments that would promote transit and pedestrian use and minimize growth related impacts in other areas. This alternative would be the most supportive of a more accessible and efficient regional public transportation system, including high capacity transit service within and beyond Seattle.

The *Land Use and Transportation Plan for Downtown Seattle (1985)* is directed toward keeping the downtown area the region's prominent center of business, government, and culture, and developing a thriving downtown residential population. The Plan calls for incorporating the downtown tunnel as an integral element of the downtown plan.

The downtown plan targets the Belltown area of the Denny Regrade for intensified residential and mixed use development. It also targets the Westlake Avenue/South Lake Union area and the North Kingdome and Union Station Corridor areas as transition areas ripe for focused planning and redevelopment.

Framework policies within the plan cite the need to emphasize transit and ridesharing as the primary means of access to downtown and assign highest priority to transit and high occupancy vehicle improvements that serve commuter travel and transit and pedestrian improvements that serve internal circulation.

The *Draft Northgate Area Comprehensive Plan (1991)* promotes development of a high density mixed use core compatible with high capacity transit service. The transportation element of the Plan focuses on reducing area-wide single-occupant vehicle trips by altering parking and supply costs, establishing an aggressive Transportation Management Association, improving access to transit, and developing an attractive pedestrian network. The Plan also supports development of new HOV facilities and priorities on arterial streets. The Plan also calls for integrating rapid transit planning with local area plans and avoiding use of the Northgate area for an interim high capacity terminus.

The draft plan provides strong support for development of a well integrated high capacity transit station within the Northgate area that will enhance the multifunctional character, environment, and economic vitality of the Northgate area. It provides a comprehensive framework for local station area planning.

The unofficial *Concept Plan for the University District (1990)* calls for providing a rail or busway transit system that serves the needs of the University District, with

conveniently located stations on or near campus, supported by efficient bus feeder service. It also calls for increased use of transit, vanpools, and carpools to reduce peak period traffic congestion.

Resolution 25899 (1978) specified interim transportation policies to guide the resolution of transportation issues. It included the goal of increasing the convenience, reliability and comfort of transit services as an effective alternative to automobile traffic."

Resolution 27750 (1988) supported accelerated construction of a regional light rail system.

Resolution 27752 (1988) addressed public transportation priorities. The resolution includes the objective of land use policies which concentrate land uses and create markets for transit.

Resolution 27911 (1989) states the City's support of accelerated development of a cost-effective, comprehensive, multi-modal, public transportation program that includes a regional rail element. The Resolution affirms that:

The regional rail system should ... concentrate employment and housing and minimize sprawl ... encourage transit use and decrease reliance on automobile use ... enhance the frequency and coverage of local and intra-city transit service ... provide transit capacity to allow for continued growth in Downtown Seattle's employment past the year 2000.

Resolution 288268 (1990) requests consideration of particular alignment alternatives and other improvements during the Alternatives Analysis phase of the regional transit project. These alignments are considered in the System Plan.

Resolution 28314 (1991) concerns the construction and operation of the I-90 center roadway across Lake Washington. With this resolution, the City indicates its commitment to prioritizing public transportation over general traffic improvements in order to satisfy regional transportation demand.

Resolution 28315 (1991) states the City's concern that there be direct two-way transit access between Rainier Avenue and I-90 and the downtown bus tunnel to facilitate access between the Rainier Valley and destinations within the City and the County. This access is included in the three build alternatives.

Both the Rail/TSM and Transitway/TSM Alternatives would be consistent with the City of Seattle's Plans, although the Rail/TSM Alternative would be better able to accommodate anticipated future passenger volumes. The TSM Alternative would also be consistent with City Plans but less supportive of both existing and future

development patterns than the alternatives which incorporate high capacity transit service. The No-Build Alternative would be counter to a broad range of City goals.

North Corridor outside Seattle

City of Edmonds. The City of Edmond's *Comprehensive Plan* (date) is oriented toward retention of a small-town atmosphere. Multi-family residential development is encouraged near arterial and collector roads. The transportation section includes an integrated set of goals and policies which address parking, pedestrian and bicycle facilities, and public transportation in general terms.

City of Everett. The *City of Everett General Plan (1987)* assumes that the downtown Everett will continue to be the focal point of commercial, governmental, cultural, and recreational activities within Snohomish County, and that the public transportation system will continue to emphasize this as a destination point. It also assumes that the majority of new development and residential growth within the city will occur in areas south of Madison Street; that there will be significant redevelopment within the downtown area; and that the automobile will continue to be the dominant form of transportation for most residents. Redevelopment plans for the Harborfront and Riverfront areas emphasize developing better linkages and access with the downtown core. Commercial goals include preserving and improving existing commercial areas in preference to creating new business districts, and encouraging the development of compact concentrated commercial centers. Central business district policies include promoting a diverse mixture of uses, including high density housing. Existing policy promotes a number of development characteristics, such as mixed uses and higher density development within the central business district and better pedestrian linkages and amenities. The transportation/ circulation element supports development of a link to the regional high capacity transit system along the I-5/Evergreen Way corridor and calls for encouragement of development which is compatible with development of a rapid transit line.

The recently completed *Everett 2000 Report (1991)* outlines key issues, ideas, goals and action strategies recommended for consideration in the development of Everett's new comprehensive plan being prepared in response to the Growth Management Act. Goals include encouraging and supporting the development of efficient low cost mass transit as an integrated regional system. Actions include:

- o Planning and implementing land use and development patterns which encourage transit
- o Extending the interstate highway HOV lanes to Everett
- o Providing transit amenities that promote transit use.

The City of Everett is also amending its Zoning Code to provide more flexibility to facilitate development of transit-friendly projects.

The build alternatives are consistent with adopted City policy. The Rail/TSM Alternative would provide the high capacity link to the regional rapid transit system called for in the general plan. The No-Build Alternative would be less consistent with existing plans.

City of Lynnwood. The *City of Lynnwood Policy Plan* (1989) emphasizes the residential character of the City with an emphasis on single family housing. It also cites an intent that the city continue to develop as a commercial and cultural center serving South Snohomish County. The Plan includes the goal of working toward a cost-effective, high capacity regional transit system. It also identifies goals for promoting land uses and parking regulations that will increase ridership to the high capacity transit stations and protecting nearby abutting residential and commercial areas from overflow transit parking.

Lynnwood's *Comprehensive Plan Map* (date) has been amended to identify the regional high capacity transit corridor running along I-5, with three station areas within Lynnwood. These station areas are included in the Rail/TSM Alternative.

Both the Rail/TSM and Transitway/TSM Alternatives are consistent with Lynnwood's goals, objectives, policies and plans with respect to regional high capacity transit service. The TSM Alternative, while providing some consistency with the Plan by increasing public transit options and efficiency, would not provide high capacity transit service as provided for in Lynnwood's plans. The No-Build Alternative would be least consistent with Lynnwood's plans.

City of Mountlake Terrace. The *Mountlake Terrace Comprehensive Policy Plan* (1983) includes land use policies which are generally supportive of public transit. The transportation goals and policies are also generally supportive of public transit.

Based on recommendations included in the *Mountlake Terrace Station Area Study* (1989) Mountlake Terrace's Comprehensive Plan was amended to endorse future high capacity transit service in the I-5 corridor, including two potential high capacity transit stations within the city. Potential station areas along the I-5 corridor include the vicinity in 220th Street and the vicinity of 236th Street and are included in the Rail/TSM Alternative. Amended planning goals and policies also include ensuring that future land uses are compatible with the proposed high capacity transit system and station areas; encouraging developers to promote pedestrian activity and transit ridership; increasing the pedestrian accessibility and carrying capacity of the streets which will serve station areas; and managing parking requirements to encourage transit use.

The Rail/TSM Alternative is most consistent with the Mountlake Terrace plan. The Transitway/TSM Alternative is also generally consistent with adopted high capacity transit policies, but does not respond to the specific policy focus on high

capacity rail service. The TSM Alternative would be consistent with Mountlake Terrace's adopted plans, but less so than the Rail/TSM and Transitway/TSM Alternatives. The No-Build Alternative would not be responsive to Mountlake Terrace's adopted plans.

South Corridor outside Seattle

Algona. The city is in the process of adopting a comprehensive plan in accordance with the GMA requirements.
The *City of Algona Comprehensive Plan (1986)* does not have any specific policies to address public transportation or rapid transit. The introduction notes however that the city came into existence primarily as a station on the interurban railway between Tacoma and Seattle. The comprehensive plan endeavors to maintain the city's current standard of living.

Auburn. The City of Auburn is in the process of adopting a comprehensive plan in accordance with the GMA requirements. *Auburn's Comprehensive Plan (1989)* states that Auburn is a family community, and a priority is placed on family values, managing potential economic opportunities in a manner that provides necessary employment and fiscal support for needed services, and responding to the need to provide affordable housing. An Urban Form Objective is to physically separate the "region-serving" employment centers and other regionally-oriented land uses from areas that are residential or local in character and maintaining Auburn's downtown as an area that uniquely serves both regional and community needs. The downtown area is designated as the "focal point of the community with a mix of uses appropriate to fulfill that role." On the valley floor, areas that are suitable to support large-scale economic development projects are to be reserved to support Auburn's role as a regional employment and commercial center. The remaining areas are reserved for uses which are local in character or which serve local markets.

The Plan calls for the continued development of "mass transit systems and other alternatives to single occupant vehicle travel" including carpooling and vanpooling, to relieve congestion and reduce reliance on the automobile for personal transportation needs. Policies state that the city will continue to coordinate with Metro to provide adequate bus service between Auburn and other King County areas as well as explore opportunities for improved bus service within the city itself. The Plan also encourages Metro to explore linkages to the south with Pierce Transit. Metro's development of "adequate park and ride facilities in appropriate locations" is supported by the Plan.

The Comprehensive Plan's parking related policies do not seem to be particularly transit supportive outside of the designated downtown area. The Plan's objective is stated "To ensure adequate parking needs with traffic development needs." Specific policies state that in commercial areas special care is needed to ensure adequate parking in order to reduce potential congestion. The *Downtown Parking Plan* is

adopted as an element of the Comprehensive Plan. Adequate parking in the downtown is promoted as a critical measure in implementing the downtown policies and rehabilitation policies of the Plan. The Plan recognizes that all businesses in the downtown will be hindered if adequate parking is not available. Flexibility is necessary in parking requirements to accommodate the reuse of existing buildings and accommodate new development. The Plan recommends that such flexibility be directed at "seeking to pool parking resources through such mechanisms as payment in lieu of parking when such parking cannot be provided by the business." The Plan also states that in the designate downtown, public development of parking is appropriate.

The *Downtown Auburn Design Master Plan (1990)* contains specific design policies and plans for a rail transit station in downtown Auburn. The Plan suggests that a phased improvement program should be in place for the area around the station site. This is proposed as a joint effort by the city, Metro and local property owners. Proposed elements of this program include pedestrian access and links to downtown, design character, parking, street landscaping, signage, a "gateway structure" to provide for bus/rail connections and other commuter services, and exterior improvements to existing surrounding buildings. The design Master Plan states that the rail transit station will be a new "front door" for the downtown.

Des Moines. The City of Des Moines is in the process of adopting a comprehensive plan in accordance with the GMA requirements. The *1981 - 1990 Greater Des Moines Comprehensive Plan (1981)* includes goals and policies addressing public circulation issues. Specifically, the City of Des Moines will encourage the use of public transportation systems in order to maximize energy conservation and circulation efficiency. The Comprehensive Plan policies also state that Metro's routes and services will be used as positive aids in the development of the greater Des Moines planning area's desired land use patterns set forth in the Comprehensive Plan. A final public transportation policy encourages Metro to offer park-and-ride lots and other services which are "as convenient, comfortable and inexpensive to the user as possible."

Federal Way. The newly created City of Federal Way has selected consultants to prepare their *City Center/Transportation Plan*. The Plan will replace the interim plan (the *King County Federal Way Activity Center Plan*) adopted when the city was incorporated. This Plan will include a city-wide land use and transportation system concept. The concept will consider the interrelationships between the various neighborhoods and land uses within the city (commercial nodes, single family and multiple family areas, the City Center, West Campus, Pacific Highway South Corridor, 348th Street node) and develop a concept that integrates them. The transportation element will guide near term transportation improvements, and provide direction for the transition to a more pedestrian oriented, multi-modal system in the long term.

The City Center Study element will provide specific direction for how the city's emerging downtown should look in twenty years. It is proposed to integrate the new transportation system, provide the necessary ridership for high capacity transit, and encourage the transition to a more urban and pedestrian environment.

The City's Interim Comprehensive Plan (1990) has several transportation goals and policies that address public transportation and regional rapid transit. One policy in particular states that the city will participate in the regional planning and decision process to implement high-capacity transit systems, and, where appropriate or in agreement with regional plans, reserve rights-of-way for high capacity transit as development occurs.

Fife. The *City of Fife* is in the process of adopting a comprehensive plan in accordance with the GMA requirements. The City of Fife's *Comprehensive Land Use Plan (1990)* does not address rapid transit, but has a policy regarding public transportation. This policy states that the city encourages "the use of mass transit, park-and-ride lots, etc., to minimize traffic in the area."

Kent. THe CIty of Kent is in the process of adopting a comprehensive plan in accordance with the GMA requirements.
The *City of Kent Comprehensive Plan (1977)* contains a goal and four objectives addressing basic public transportation needs. The objectives are to:

- Coordinate closely with other agencies and jurisdictions on transportation planning and construction activities;
- To encourage the establishment of an efficient regional and local feeder mass transportation system, both public and private;
- To encourage the use of mass transit; and
- To encourage and support the safe and efficient use of rail transportation for movement of both goods and people.

The last goal includes a policy encouraging the public or private utilization of the existing rail lines for mass transit purposes.

In subsequent years, the City of Kent has adopted other components of the comprehensive plan to address issues in certain identified neighborhoods of the City. These include the *East Hill Plan (1982, modified 1984)*, the *West Hill Plan (1984)*, and the *Downtown Kent Plan*. Each of these plans contains policies that address public transportation and which are based on the general policies of the Comprehensive Plan described above. The Kent Downtown Plan's Circulation Goals and Policies include policies to encourage the "implementation of carpooling, flex-time, public transportation and other transportation measures for new development that reduce vehicular traffic but not the overall number of shoppers and/or employees" in the downtown Kent area. Another policy is to "provide

opportunities for both light rail and heavy rail commuter transportation to locate within the Planning Area" (emphasis added). Other policies are "to promote and support efforts to integrate the use of the railroad lines in the overall transportation serving downtown" and "to support and encourage public transportation to link the Planning Area to adjacent commercial and industrial areas as well as residential areas."

Transportation goals of the West Hill Plan include:

- Promote alternative modes of transportation; and
- Promote the use and expansion of public transit.

Transportation policies are to:

- Encourage (an) intracity public transit system;
- Encourage public transit to shopping centers, especially downtown Kent (i.e. utilizing vans);
- Encourage continuous daily transit service on West Hill.

The transportation goals of the East Hill Plan include developing a transportation management program that incorporates all modes of transportation. Policies include: encourage expansion of the Metro system and encourage (an) intracity public transit system.

Normandy Park. The Town of Normandy Park is in the process of adopting a comprehensive plan in accordance with the GMA requirements.

Pacific. The Town of Pacific is in the process of adopting a comprehensive plan in accordance with the GMA requirements.

Puyallup. The City of Puyallup is in the process of adopting a comprehensive plan in accordance with the GMA requirements.

Renton. The City of Renton's *Comprehensive Plan Compendium (1986)* is in the process of being updated to meet the requirements of the state Growth Management Act. The Land Use Element of the plan is the subject of an EIS which is scheduled to be released in late 1991. The Transportation Element, along with others will also be updated in 1992-93.

SeaTac. The recently established city of SeaTac is in the process of preparing a Comprehensive Plan which will include policies regarding public transportation and rapid transit. The *Sea-Tac Area Update (1989)* which was adopted as an amplification and augmentation of the *King County Comprehensive Plan (1985)* will be the basis of the comprehensive plan. The Sea-Tac Area Update contains a few policies concerning transit including:

- Improve Sea-Tac area transit service, especially in east and west directions;
- Provide good transit connections between major employment and commercial centers;
- Encourage the development and use of higher occupancy travel modes (light rail, bus, carpool, etc.) over single occupant vehicles by increasing coordination efforts between Metro, public agencies and the private sector;
- The Port of Seattle should work with Metro to provide convenient transit stop location(s) and should include a location for access for future high capacity transit at SeaTac Airport.

Sumner. The Sumner Comprehensive Plan (1983) does not contain goals or policies specifically addressing public transportation or rapid transit. One of the Plan's transportation and circulation goals is to "provide a balanced transportation system that promotes access to all areas of the City and to all types of users in a safe, economical and efficient manner."

Tacoma. The City of Tacoma's *Generalized Land Use Plan (1980)* contains transportation policies to assist in achieving the City's Growth and Development Goals. Policies relating to public transportation or rapid transit address such issues as intergovernmental coordination, land use consideration, reflecting citizen needs, integrated downtown transportation system, transportation corridor as boundaries, activity centers arterial connections, evaluating land use impacts, land use coordination and integration and minimizing adverse impacts.

Tukwila. The City of Tukwila *Comprehensive Land Use Policy Plan* (1982) includes Element Goals for Transportation/Utilities (or "Infrastructure") and the Transit Objective to "promote an effective and viable mass transit system which ties the Tukwila area to the region". The objective contains four efficiency-related policies which call for: coordinating with Metro "for the best and most useful transit service for local citizens"; supporting efforts to increase transit use; promoting the development of more cost-effective methods of rapid transit; and promoting freeway transit stops in conjunction with local park-and-ride lots. The last policy states that it encourages faster and more frequent transit service to the local citizenry and "avoids unnecessary delay by creating a separate transit lane within the freeway right-of-way for boarding of passengers." Another objective in this element addressing non-motorized facilities contains a policy which calls for integrating bicycle, pedestrian, bus and street systems and developing "accomodating and safe mechanisms of transferring from one mode of transportation to another."

While not specifically mentioned in Tukwila's comprehensive plan, all of the build alternatives could be considered to be consistent with its goals, objectives and

policies, especially the TSM Alternative. The No-Build Alternative would not be consistent with the City's Comprehensive Plan.

East Corridor

Eastside Transportation Program. The Eastside Transportation Program (ETP) is a cooperative effort of public agencies and private sector representatives working on Eastside transportation problems. Public participants include Bellevue, Bothell, Kirkland, Issaquah, Redmond, King County, WSDOT, PSCOG, and Metro. The ETP *Recommendations Report* includes a goal to provide facilities and services which support and encourage transit and ridesharing as attractive alternatives to use of the single occupant vehicle (SOV). Policies include completion of the regional freeway HOV network, creation of an integrated system of arterial HOV improvements, provision of a system of park-and-ride and park-and-pool lots to intercept SOVs close to trip origins, improving intra-Eastside transit service, intensifying transit links from the Eastside to regional activity centers, developing attractive transit options, improving ridesharing services, and encouraging better design of developments to facilitate transit service. The plan provides for aggressive and co-ordinated regional TDM programs. The plan also recommends a high priority be given to high-capacity transit on the Eastside, particularly in the I-90, I-405, and SR-520 corridors, and suggests identifying and preserving necessary right-of-way as soon as possible and implementing land use changes that will support an HCT system. The ETP's *Eastside Transit Priorities (1991)* suggests that rapid transit service should directly serve the Bellevue CBD. The timing for inclusion of other centers should depend on the results of system planning evaluation. However, jurisdictions which do not receive initial rapid transit service should be compensated with adequate regional transit and highway service to allow them to grow as planned.

By providing rapid transit service, the Rail and Transitway/TSM Alternatives are most consistent with the ETP's recommendations. The service concept of the three build alternatives is consistent with the recommendations. The No-Build Alternative is not consistent with the ETP's recommendations.

I-90 Memorandum of Agreement. The I-90 Memorandum of Agreement (MOA) (signed by King County, WSDOT, Metro, and the cities of Seattle, Mercer Island, and Bellevue) called for the I-90 center roadwaqy to be a reversible HOV facility with access for Mercer Island general-purpose traffic. The three build alternatives are not consistent with this and would require modifications to the MOA.

Bellevue. The *City of Bellevue Comprehensive Plan (1989)* defines Bellevue as a community comprised largely of single-family neighborhoods in an open and natural setting, together with a regional urban center and a broad range of other support services. Downtown Bellevue is emphasized as the principal economic, financial, business, retail, and community center of the city. High-density employment and residential development is welcomed and encouraged in the CBD. High-density

employment development outside the CBD is limited. The plan aims to increase the efficiency of the transportation system by encouraging ridesharing and transit usage. This is to be implemented by parking management, encouraging transportation demand management, preferential treatment for HOVs, and increasing transit accessibility. The plan also calls for completion of HOV improvements along the major freeways. The plan specifically endorses a high capacity regional transit system connecting the Bellevue CBD with other regional centers. It also provides for increased utilization of public transit in most of the subarea plans. The Rail/TSM Alternative is most consistent with the plan by developing a high-capacity transit line through the Bellevue CBD and providing efficient public transportation through the rest of Bellevue. The potential South Bellevue station, however, could conflict with the low-density single-family nature of that neighborhood by increasing development pressures. The Transitway/TSM Alternative would be somewhat less consistent than the Rail/TSM Alternative by providing less direct access to the Bellevue CBD. The TSM Alternative, while providing some consistency with the plan by increasing public transit options, would not provide high-capacity transit, as provided for in the plan. The No-Build Alternative would be least consistent with the plan.

Bellevue's *CBD Implementation Plan* (1989) is an action plan to meet the transportation and design needs of downtown Bellevue through the year 2000. The recommended action plan includes public improvements such as streets, sidewalks, and parking, as well as programs and services such as ridesharing and transit. An expanded and relocated transit center is a major part of the plan's transit program. The transit center would be located on Northeast 6th just east of 112th Avenue Northeast and would be linked to I-405 with transit-only ramps. A transit shuttle or people mover would link the transit center to Bellevue Way along Northeast 6th. In addition, HOV lanes would be provided on Northeast 8th and Northeast 10th Streets. The elements of the plan are similar to those in the TSM and Transitway/TSM Alternatives, which are thus consistent with the plan. The plan does not provide for rail access to the CBD. In addition, the Rail/TSM Alternative does not provide the bus access facilities provided under the other two alternatives. The Rail/TSM Alternative is thus less consistent with this plan.

Bothell. The *Comprehensive Plan (1971)* defines Bothell as primarily a residential community, now and in the future. However, the plan also provides for commercial development in the CBD, along SR-522 to the west of the CBD, and along State Route 527 to the north of the CBD. The plan also provides for industrial development to the east of I-405. The original plan makes little provision for mass transit. The *City of Bothell Transportation Improvement Plan (1984)* endorses Metro's 1990 plan and recommends additional local service, including a community transit center, shuttle service to developments in the North Creek Valley, and an I-405 express stop at NE 195th Street. The plan calls for HOV lanes along I-405 and SR-522. The plan provides for linking new development to a vigorous ridesharing and transit program. The three build alternatives are consistent with the

transportation plan in providing increased transit service and links within Bothell and increasing express service in the I-405 corridor.

Clyde Hill. Clyde Hill does not have a comprehensive plan at this time.

Hunts Point. The *Town of Hunts Point Ordinance No. 57 (1964)* provides for enhancing and protecting the residential suburban character of the community. Transportation objectives focus on promoting safety on thoroughfares. None of the alternatives are consistent or inconsistent with these objectives.

Issaquah. The *Issaquah Area Comprehensive Plan (1977)* does not specifically address needs for transit, other than construction of a park-and-ride in Issaquah and an internal loop run through the city. The Plan calls for commercial development along I-90 and in the Issaquah CBD and high-density residential development near the I-90 and Front Street corridors. The *Amendment to the Comprehensive Plan, I-90 Subarea (1983)* suggests that new park-and-ride lots be located where they can intercept traffic before they reach I-90 at Issaquah. The Plan provides for higher density mixed use development in the I-90 corridor as a means to decrease the public and private costs of development. The *Tibbetts-East Cougar Subarea Plan (1990)* encourages TSM programs for development projects, as well as well-sited and designed public transit facilities and park-and-ride lots in the Cougar Mountain and I-90 area west of Lake Sammamish. The Plan provides for multifamily development in the area immediately south of the Lakemont Boulevard interchange. The City of Issaquah is updating its comprehensive plan and zoning code. The plan, to be completed by July 1993, may establish land uses and zoning which could result in higher densities and pedestrian/transit-oriented centers.

The three build alternatives are generally consistent with Issaquah's plans and amendments. Stations under the Rail/TSM Alternative would be sited in areas zoned commercial or business park. The potential station north of I-90 on the BNRR would help fulfill the goal of intercepting plateau traffic before it reached Issaquah. New and expanded park-and-rides under the Transitway/TSM and TSM Alternatives would also be consistent with the plan, as would the increase in service under the three build alternatives. The No-Build Alternative would be less consistent with Issaquah's plans.

Kirkland. The *City of Kirkland Comprehensive Plan (1987)* emphasizes the City's single-family character. Multifamily development is also considered appropriate to provide a buffer zone between commercial/office uses and single family areas. The plan endorses increased economic development, generally in existing commercial and industrial districts, with the exception of vacant land west of I-405 in the Totem Lake area. Most multifamily and commercial development outside downtown Kirkland is focused on the I-405 corridor. The Plan is supportive of transit, transportation demand management, and encouraging alternatives to the single oc-

cupant automobile. The three build alternatives are equally consistent with the Plan's goals regarding transit, as is station development under the Rail/TSM Alternative at NE 85th and at Totem Lake. However, the potential station at NE 70th would probably not be consistent with the single-family nature of that neighborhood, although a park-and-ride currently exists at that location.

Medina. The *Comprehensive Plan for the City of Medina (1986)* emphasizes the predominantly residential character of the community. The plan establishes street design standards and calls for a landscaped median on 84th Avenue Northeast, which is designated for an HOV lane under the three build alternatives. The plan calls for continuation of public transportation by Metro. None of the alternatives are inconsistent with the plan.

Mercer Island. The *City of Mercer Island Comprehensive Planning Documents (1988)* emphasize the preservation of the single family character of the island. Multifamily areas have the principal function of providing a buffer or transition area between single family and business or commercial areas. The *Central Business District Plan (1987)* calls for maintaining a community scale in contrast to a regional scale commercial development. The City is interested in cooperation in the revitalization of downtown, but does not want to see the business district expand. The CBD plan calls for a permanent transit facility north of I-90 between 77th and 80th SE. The *Arterial and Circulation Plan (1976)* provides for encouraging public transportation and car pooling. The three build alternatives, by increasing options for public transportation, are most consistent with the Comprehensive Planning Documents.

Redmond. Redmond's *Community Development Guide (1989)* characterizes Redmond as an employment center and endorses employment-generating and multi-family development in much of its area, including key neighborhoods along the SR-520 corridor. Redmond has a policy of developing transit service to all neighborhoods and major employment centers, enhancing the transit environment, and developing a transit station in the city center. The three build alternatives are all consistent with the overall transit goals of the Plan. Development of a city center transit station under the Rail and Transitway/TSM Alternatives would be consistent with the Plan. Development of a city center transit station under the Rail/TSM and Transitway/TSM Alternatives would be consistent with specific policies of the City Center Neighborhood Plan. Siting of other stations under the Rail/TSM Alternative would be in areas suitable for commercial or multifamily development, and would thus be consistent with transit goals of the Community Development Guide.

Yarrow Point. The Town of Yarrow Point does not have a comprehensive plan at this time.

Recent Legislation Affecting Local Mass Transit

Growth Management Act

HB 2929, which passed on April 1, 1990, requires consistency between land use and transportation, including transit planning, on a regional level. The Act requires setting of level of service (LOS) standards for transit routes, plans for bringing facilities that do not meet LOS standards into compliance, and identification of system expansion needs. The act also requires that local jurisdictions implement measures for transportation demand management strategies, which typically includes measures to boost the usage of mass transit. Transportation plans are required to be consistent with comprehensive plans; that is, the transportation system must be capable of serving the land use, population, and employment that are provided for in the comprehensive plan, at an acceptable level of service. Conversely, the comprehensive plan must include an acquisition plan for transportation corridors.

HB 1025, which passed on June 28, 1991, provides incentives for local governments to comply with HB 2929. The bill also requires regional planning among Pierce, King, and Snohomish Counties, and for coordinated transportation planning between counties and cities.

High Capacity Transit Legislation

HB 1825 - High Capacity Transit Funding and Planning, which passed on March 3, 1990, provides authority for establishing a joint regional policy committee (JRPC) in the central Puget Sound region. The JRPC is responsible for preparation and adoption of a regional high capacity transportation (HCT) System Plan and implementation program, which are to be reviewed by an independent expert review panel. The Act lays out a process for system and project planning. The HCT Plan is to be included in overall regional transportation planning by the regional council. The Act set up a state high capacity transportation account, which could provide up to 80 percent matching assistance for high capacity transportation planning efforts. The Act gave transit agencies the power to levy, with the approval of the voters, an employer tax, a special motor vehicle excise tax, and an addition to the sales tax to fund HCT construction and operation. In addition, the Act provides a means to use HCT funds to operate or contract for commuter rail service. Finally, the Act encourages counties to adopt goals for reducing single occupancy vehicle (SOV) use and provides taxing authority that counties could use to accelerate development and increase utilization of the HOV system.

HB 1677 - High Capacity Transit Funding and Planning, which passed on April 17, 1991, details the funding, public involvement and review requirements for use of state HCT funds. Voters must approve the system Plan and implementation and

financing program. Corridor public hearings, associated with a project-level environmental review, must be held before commitment to specific route proposals is made. The System Plan EIS will cover the need for and location of the system, as well as the social, economic, and environmental effects of the system location and its alternatives. Design public hearings must be held after alignments are established, but before adoption of final design, and will cover major design features and the social, economic, and environmental effects of the design and its alternatives. HCT Plans must be reviewed by a regional policy committee with proportional representation within the HCT service area. HCT analysis must be reviewed by an expert review panel appointed by the state governor to provide independent technical oversight of the project.

HB 2151 - High Capacity Transit, which passed on April 18, 1991, details the process for coordination between agencies and local jurisdictions. The *regional planning organization* (in this case, the Puget Sound Regional Council) is to produce a regional transportation Plan, which will identify regional transportation goals, analyze travel patterns, project future land use and travel, and relate urban growth to an effective HCT system, and may identify priority corridor(s) for HCT. The *Joint Regional Policy Committee* will prepare and adopt an HCT implementation program, which will include a system Plan and a program plan for High Capacity Transit. *Interlocal agreements* among transit agencies and affected local jurisdictions will govern most aspects of HCT planning, construction, operations, and funding. These agreements will also set forth conditions for assuring land uses compatible with development of HCT. *Transit agencies* will have the responsibility to promote transit-compatible land uses and development, including joint development. They also are responsible for cooperating to develop feeder transportation systems. *Local governments*, through their comprehensive Plans, must address the relationship between urban growth and an effective HCT system Plan and provide for cooperation with transit agencies. *WSDOT* will distributes funds from the HCT account and must cooperate with local plans for HOV facilities, roadways, transfer stations, etc. The *Expert Review Panel* will provide review of system-level evaluation and reports to the governor, the legislature, WSDOT, the regional transportation planning organization, JRPC, and the lead transit agencies.

Shoreline Management Plans (SMP)

The Shoreline Management Act (1971) gives local governments the authority to regulate development along the shorelines under their jurisdiction. In general, shorelines within the limits of an incorporated city are regulated by the city, while shorelines outside of any incorporated city are regulated by the county. Therefore, the SMPs of three counties and several cities could affect the project. Table A1 lists water bodies where shorelines could be affected by the project, and the jurisdiction which implements the SMP. This list could vary depending on the final alignment chosen.

Most SMPs divide shoreline environments into four types, usually called Urban, Rural, Conservancy, and Natural. *Urban Environment* includes areas of high intensity land development, including residential, recreational, and industrial development. *Rural Environment* includes areas of agricultural use, low density residential areas where most urban services are not available, and open spaces and buffer zones between urban areas. *Conservancy Environment* shorelines are generally free from intensive development. These areas are intended to maintain their existing character in order to preserve natural resources, historic or cultural features. *Natural Environment* areas contain unique natural features valuable in their undisturbed or original condition and are intolerant of intensive human use.

In general, construction permitting of new transportation facilities is easier in urban or rural environments, and is prohibited in Natural Environments.

The permitting of transportation projects can be facilitated by using existing rail and highway rights-of-way as much as possible, avoiding environmentally sensitive areas (e.g. wetlands) unless absolutely necessary, demonstrating that efforts to minimize impacts during construction will be used, and by crossing shoreline areas in urbanized or developed areas.

Table A1. Shoreline Management Programs Potentially Affecting Rapid Transit Alternatives.

Shoreline	Applicable SMP
Snohomish River	Everett, Snohomish County
Silver Lake	Everett
Lake Serene	Lynnwood
Green Lake	Seattle
Lake Union	Seattle
Portage Bay	Seattle
Duwamish Waterway	King County, Seattle
Angle Lake	King County
Green River	King County, Kent
Star Lake	King County
Lake Doloff	King County
Puyallup River	Tacoma, Pierce County, Puyallup, Sumner
Cedar River	Renton
Lake Washington	King County, Seattle, Mercer Island, Bellevue, Renton
Sammamish River	Bothell, Redmond

Note: Other shorelines and SMPs could affect the project depending on the final alignments.
Source: Boateng & Associates, 1991.

TECHNICAL APPENDIX E

PROJECT-LEVEL METHODOLOGY

July 31, 1991

TO: Expert Review Panel

FROM: Chuck Kirchner

SUBJECT: Distinction between System-Level and Project-Level Analysis: Social, Economic and Physical Environment Methodology Report.

1.0 SOCIAL AND ECONOMIC ENVIRONMENT

1.1 LAND USE AND ECONOMIC DEVELOPMENT

System Plan DEIS

Determine consistency with local plans and zoning designations. Relationship of system and corridor alternatives to regional and local land use plans and comprehensive plan policies.

Assess generic station types (dense urban neighborhood, community business, suburban business, suburban residential, suburban with regional park-and-ride) and impacts generally associated with these types of stations. Discuss typical mitigation measures.

General discussion of role of joint development in implementation and financing of the project.

Open discussions with local land use planning officials on the interaction between Metro's planning efforts and the local jurisdiction's comprehensive planning efforts, especially in light of the Growth Management Act. Begin discussions of model ordinances/zoning overlays.

Alternatives Analysis/DEIS

Baseline inventory and mapping of existing land use, zoning and comprehensive plan designations. Refine relationship of corridor alternatives to regional and local land use plans/policies.

Adopt generic station types to potential station locations. Refine design at key (representative) stations. Analyze impacts/mitigations on the area surrounding the potential station sites.

Discuss specific joint development possibilities in conjunction with potential stations.

Continue the interaction with local planning officials on their comprehensive plan efforts; begin to focus attention on local community planning efforts along HCT alignments and near potential station locations; insure consistency between stations. Refine the model ordinances/zoning overlays and move toward their adoption.

Explore opportunities for land banking in areas where bus pulse points/park-and-rides under TSM coincide with potential station locations.

1.2 NEIGHBORHOODS & 1.3 DISPLACEMENTS/RELOCATIONS OF EXISTING USES

System Plan DEIS

Generic discussion of neighborhood characteristics and how they could be affecte by the project. Amount and type of land required by alternative. Where possible, the potential for displacements, incursion, or disruption (e.g., noise, traffic) will be discussed.

Alternatives Analysis/DEIS

Baseline inventory identifying neighborhood characteristics, with the assistance of a public involvement process, local knowledge of the project, involvement of neighborhood groups, the affected municipalities within each corridor and representatives of King, Pierce, and Snohomish counties and the Puget Sound Regional Council (the MPO).

Quantifiable neighborhood or planning district characteristics will be presented for both the base and horizon year for the following: population, number of housing units, income characteristics, racial characteristics and employment.

Transit alternatives as identified by the System Plan will be overlaid on maps of identified neighborhoods and planning districts so that impacts of the proposals can be assessed. The potential for displacements, incursion or disruption (e.g. noise, traffic) will be discussed.

Tabulate, by planning district, where displacements (if required) will occur. Identify the degree of incursion or disruption in any impacted neighborhood. Determine if any of the alternatives will split a neighborhood in a way that would create an impediment or affect its identity. Neighborhoods that could potentially undergo a change in character because of development associated with or induced by transit station development will be discussed. Other impacts to be discussed include: impacts resulting from the displacement of households and businesses; changes in neighborhood or community cohesion; changes in travel patterns and accessibility; impacts on school districts, recreation areas, churches, businesses, police and fire protection, including direct impacts and indirect impacts resulting from the displacement of households and business. General social groups specifically adversely affected or benefitted by the alternatives. Impacts on the quality of life of a neighborhood.

Estimate the number of displaced residential and business units as well as partial property takings that do not alter the primary use. Identify the public facilities that will be displaced or otherwise affected. Assess the character of households to be displaced. Identify the availability of comparable replacement housing or business space for displaced uses.

Where it is determined there will be impacts, mitigation measures will be proposed and discussed for each alternative commensurate with the level of impacts.

1.4 VISUAL AND AESTHETIC RESOURCES

System Plan DEIS

Establish a baseline inventory of visual and aesthetic resources for each corridor and prepare maps indicating the location of these resources. Discuss the general visual and aesthetic characteristic of residential and non-residential environments. Classify the relative importance of visual and aesthetic landmarks. Discuss in general the impacts on visual and aesthetic resources expected to result from the proposed alternatives.

Alternatives Analysis/DEIS

Conduct visual field surveys (by foot or from car) and map findings using urban design notation. Identify sensitive and affected areas. From specified points along each alternative identify visual and aesthetic impacts relative to different land use types. Evaluate the visual impacts of the candidate technologies.

Recommend potential mitigation measures to screen sensitive areas, reduce obstruction or enhance the user experience. Changes in facility alignment (vertical and/or horizontal) and location will be recommended as appropriate.

1.5 HISTORIC, CULTURAL AND ARCHAEOLOGICAL RESOURCES

System Plan DEIS

Inventory areas or sites of known historic, cultural and archaeological resources. Describe in general the potential impacts of construction and operation of the proposed project on historic, cultural and archaeological resources. Discuss generally accepted mitigation measures.

Alternatives Analysis/DEIS

Field check material compiled from existing data bases (county, state, national). Perform a field investigation of areas not yet surveyed. Contact appropriate member of the Association of King County Historic Associations for information that may lead to identifying potentially historic properties. Evaluate properties identified in the field investigation using National register and local landmark criteria. G.Collect information on settlement history and prepare a general development history of the area to place cultural resources in their historic context for each corridor alternative.

1.6 PARKLANDS

System Plan DEIS

Inventory and map existing parklands, recreation areas, open spaces, and wildlife refuges near proposed improvements. Identify parkland areas along each corridor that could be significantly affected.

Alternatives Analysis/DEIS

Establish coordination with parks agencies. Identify planned improvements to existing parklands and the development of new parklands for the horizon year. Record the visual qualities of existing parklands using video technology and 35 mm

photos. Develop computer-simulated images of existing and future conditions illustrating locations of existing and future parklands relative to corridor alignments. Determine the extent of impact to the affected parklands relative to existing and future uses by the extent of physical intrusion, loss of intended usability and compatibility.

1.7 TRANSPORTATION FACILITIES

System Plan DEIS

Prepare baseline information from system and corridor performance measures from the modeling process, including service levels and patronage numbers. Describe the facilities and service provided by each alternative.

Alternatives Analysis/DEIS

Describe the projected travel markets and the changes in transit travel and ridership expected with each alternative. Prepare a service level analysis. Analyze traffic impacts including measures for assessing differences in the traffic impacts of each alternative relative to the no-build. For those measures which do not come directly out of the model, such as circulation and congestion impacts near proposed fixed guideway stations additional analysis will be performed to develop approach volumes at critical intersections and to estimate level of service under the various alternatives. Station locations for which further analysis of mitigation measures may be necessary.

1.8 UTILITIES

System Plan DEIS

Gather baseline information on location of existing utility facilities on or adjacent to alignments. Identify all operators of public and private utilities. Document or secure documentation of all existing facilities within 1/4 mile of all proposed facilities.

Discuss generally the impacts of construction such as relocation and disruption of services. Discuss mitigation measures generally accepted to minimize the impacts.

Alternatives Analysis/DEIS

Identify and locate the potential for direct impacts to utility facilities such as disruption, physical intrusion, relocation requirements, damage during excavation and damage to storm drain facilities from sedimentation caused by construction-related erosion.

Discuss indirect impacts on utilities resulting from new development adjacent to station sites.

Discuss mitigation for direct and indirect utility impacts.

2.0 PHYSICAL ENVIRONMENT

2.1 SOILS GEOLOGY AND SEISMIC SETTING

System Plan DEIS

Collect and map baseline information of soils, geology, and seismic setting from local, state, and federal agencies. Describe generic impacts of construction and operation of the alternatives. Discuss potential mitigation measures.

Alternatives Analysis/DEIS

Collect additional inventory information from private property owners along the alignments. Assess impacts of the proposed transit system through discussions with the design team consultants as well as the appropriate local, state, and federal agencies. Identify and assess options for mitigation measures. Develop measures to provide compensation for unavoidable adverse impacts.

2.2 ECOSYSTEMS (WETLANDS WILDLIFE AND VEGETATION)

System Plan DEIS

Inventory and map the baseline conditions and locations of wetlands, lakes, streams, plant communities, environmentally sensitive areas, and threatened and endangered wildlife habitat. Impacts on terrestrial and aquatic ecosystems due to the construction and operation of the alternatives will be discussed. General mitigation measures will be discussed.

Alternatives Analysis/DEIS

Potential alignment alternatives construction limits will be estimated and used to assess the extent of impacts on ecosystems. Impacts to wetlands and other plant communities will be relative to the identified functions of the wetlands and the level of physical disturbance. Impacts to wildlife, including threatened and endangered species will be assessed in terms of critical habitat loss. Mitigation measures will be identified and discussed with the appropriate local, state and federal agencies. Compensation for unavoidable impacts will be discussed.

2.3 WATER QUALITY AND HYDROLOGY

System Plan DEIS

Prepare a baseline inventory of all surface water bodies, including drainage basins and floodplains, in the project area. Assess surface water quality impacts through a review of runoff water quality studies. Map corridor alignment alternatives on Federal Emergency Management Agency floodplain maps. Describe requirements of local Shoreline Master Programs and the methods of meeting these requirements.

Alternatives Analysis/DEIS

Evaluate the impacts on the quantity of surface runoff for each corridor using techniques developed by the U.S. Soil Conservation Service. Use the runoff water quality data in conjunction with hydrogeologic maps to determine the impacts on groundwater quality. Where tunnels are proposed for alignments, assess the impacts

on groundwater flow. Discuss federal requirements for navigable waterways permits, where alignments cross such waterways.

2.4 NOISE AND VIBRATION

System Plan DEIS

Characterize existing noise environment. Describe and assess noise associated with transit operations using FTA's Guidance Manual for Impact Analysis for Transit Noise. Discuss construction related noise and vibration impacts.

Alternatives Analysis/DEIS

Identify sensitive receptor sites and sites sensitive to vibration within 1,000 feet of the alignments. Address noise and vibration impacts at station sites. Present more detailed noise and vibration analysis for alignments if warranted. Discuss mitigation measures for construction related noise and vibration as well as operational impacts.

2.5 AIR QUALITY

System Plan DEIS

Establish baseline air quality character with existing sources of data. Document existing air quality conditions and trends.

Prepare a mesoscale analysis to document the change in regional emissions expected from the implementation of the rapid transit project alternatives. Estimate motor vehicle emission rates using the U.S. EPA MOBILE 4.1 emissions model.

Alternatives Analysis/DEIS

Conduct a microscale air quality analysis to estimate future concentrations carbon monoxide at specific locations (i.e. station sites) on the rapid transit project alternative alignments. The microscale air quality analysis will generally follow procedures specified in the U.S. EPS manual Guidelines for Air Quality Maintenance Planning and Analysis Volume 9. Emission rates will be estimated using the MOBILE 4 mobile source emissions model. Intersections will be analyzed using the ITE 1985 Highway Capacity Model. Dispersion estimates will be made using the CALINE 3 and/or CALINE 4 models. Air quality impacts will be evaluated by comparing predicted future CO concentrations to the state and federal air quality standards. Evaluate the conformance of alternatives with adopted air quality transportation control measures in consultation with PSAPCA.

2.6 ENERGY

System Plan DEIS

Compare operational energy requirements of each alternative. Compare the operational energy requirements of each alternative relative to the available regional energy resources.

Alternatives Analysis/DEIS

Identify energy costs and/or savings relative to the operation and construction of each alternative determined through the increased energy requirements of nontransit modes compared to the no-build alternative. Mitigation measures will be proposed including a discussion of alternative energy sources.

2.7 HAZARDOUS WASTE/MATERIALS

System Plan DEIS

Determine areas of historic or current manufacture, use or storage of hazardous materials to identify known or suspected hazardous waste sites. Review available information from the state Department of Ecology and the U.S. Environmental Protection Agency. Contact local government agencies for records of hazardous materials in use or storage, including PCBs.

Alternatives Analysis/DEIS

Conduct field surveys of each corridor to identify unlisted sites. If necessary conduct a Phase I Site audit to further evaluate the possibility of contamination at a site. Describe the constraints that the identified hazardous materials sites may have on the project. Compare costs for each alternative for: I) cleanup and disposal of hazardous material on a worst case basis; 2) cleanup and disposal on a likely-case basis; 3) avoidance of hazardous sites by modifying project alignments.

TASK 3.0
DRAFT METHODOLOGY REPORT
REGIONAL TRANSIT PROJECT
ALTERNATIVES ANALYSIS/DRAFT ENVIRONMENTAL IMPACT STATEMENT

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INTRODUCTION

This report describes the methodology which will be employed to prepare the social, economic and physical environmental impact assessment for the Alternative Analysis/Draft Environmental Impact Statement (AA/DEIS) for the Regional Transit Project. As specified in the Project Management Plan for the Environmental Studies, this report will present the work program and methods to be used to develop the existing baseline of social, economic and physical environmental conditions; assess the potential impacts of the proposed transit alternatives; and evaluate mitigation strategies for the following areas:

Social and Economic Environment

- Land use and economic development
- Neighborhoods
- Displacements/relocations of existing uses
- Visual quality and aesthetic resources
- Historic, archaeological, and cultural resources
- Parklands
- Transportation facilities
- Utilities

Physical Environment

- Soils, geology and seismic setting
- Ecosystems
- Water quality and hydrology
- Noise and vibration
- Air quality
- Energy
- Hazardous waste/materials

1.0 SOCIAL AND ECONOMIC ENVIRONMENT

1.1 LAND USE AND ECONOMIC DEVELOPMENT

1.1.1 Introduction

This task seeks to describe the existing conditions, potential adverse impacts, and possible mitigation measures for each of the Regional Transit Project (RTP) alternatives in terms of land use and economic development within the three identified corridors, north, south and east.

1.1.2 Baseline

A description of generalized existing land use and economic conditions within the RTP corridors will constitute a baseline from which potential impacts can be assessed.

Land Use

Existing land use and development trends will be described within each of the three study corridors to identify potential opportunities and constraints for RTP development. Comprehensive plan and zoning designations of applicable local jurisdictions will also be

described to define currently envisioned future uses. The Puget Sound Regional Council (PSRC) preferred alternative contained in the Vision 2020 plan and the growth management plans for King, Pierce and Snohomish Counties will also serve as resources for describing future conditions.

Specific tasks include:

a. Identify the land use jurisdictions responsible for such planning within the RTP corridors. Assess each jurisdiction's commitment to encourage rapid transit-compatible development along the RTP alignments.

b. Describe and map (by alignment) existing land use, zoning and comprehensive plan designations, and development activity. Assess consistency between comprehensive plan designation, zoning, and existing land use in conjunction with local jurisdictions and community organizations in order to recognize the interpretive history and intent of the plans.

c. Quantify existing land use (in acres) by type (single family residential, commercial, etc.) within each corridor and within one half-mile of each station area.

d. Map the projected 2010 land use for each corridor and within one half-mile of each station area based on published sources (e.g. PSRC).

e. Identify developable and redevelopable areas within 1/2 mile of station sites through a susceptibility-to-change analysis that evaluates land for criteria such as:

   - Land Utilization: vacant versus developed sites
   - Physical Constraints: degree to which natural features constrain development
   - Zoning Utilization: degree to which existing development maximizes zoning and comprehensive plan potential (permitted uses and density)
   - Location: relative to other activities, access, visibility
   - Planning Project: development/redevelopment currently under active consideration.

f. Identify existing land uses potentially affected (positively or adversely) by the construction and/or operation of a rapid transit system, as well as those uses that could impact (positively or adversely) such a system. This task begins the identification of land use compatibility with rapid transit system development along identified alignments within the three corridors and around planned rail stations. In general, high density residential, commercial, and industrial uses are considered most compatible with rapid transit; while low density, single family residential development has the least compatibility.

The work will be accomplished by field investigations; review of aerial photographs, platting maps, comprehensive land use plans, zoning maps and codes, and other secondary sources; and follow-up interviews with local jurisdictions. Data sources will include:

- Cities of Seattle, Lynnwood, Mountlake Terrace, Edmonds, Bothell, Kirkland, Redmond, Bellevue, Mercer Island, Tukwila, SeaTac, Renton, Burien, Federal Way, Des Moines, Milton, Fife and Tacoma
- The Counties of King, Pierce and Snohomish
- Metro, Pierce Transit and Community Transit Authorities
- Puget Sound Regional Council

- Consultant Team Library/Resources.

Economic Development

Existing economic and development trends for areas within the regional transit corridors will be documented. The information to be compiled will include:

- Local economic development goals and policies
- Population and employment trends/projections, using data provided by Metro, PSRC and other sources
- Nature and size of economic activity centers located within the corridors
- Major development projects planned within the corridors
- Identification of areas/parcels with opportunities for development and/or redevelopment (see discussion under land use).

To accomplish this documentation, the consultants will meet with the various City and County economic development departments and Metro to gather existing data bases. Other secondary data sources and publications will be utilized.

1.1.3 Impact Assessment and Mitigation

Land Use

Potential land use impacts associated with each of the alternatives will be identified. Impacts will be assessed both on the general corridor level, and more specifically for areas within one-half mile of potential station and interim terminus locations. The analysis will address the potential impacts of construction, including the amount and type of land required; zoning and use of property acquired; identification of businesses and residences displaced, including the number of employees and residents; physical disruptions to adjacent land uses; and impacts on community cohesion, sensitive land uses and disadvantaged populations. This section will also address potential land use changes as a result of rapid transit operations. Susceptibility-to-change and land use compatibility analyses will stand as critical inputs to assessing land use impacts under each RTP alternative.

The impact assessment will focus on the following issues:

1) The degree of compatibility of surrounding land uses with rapid transit system development under each alternative.

2) Land use changes that might occur under each alternative as a result of construction and/or operation of rapid transit facilities.

3) The ability to mitigate disruption through relocation assistance or other means.

Economic Development

Potential economic impacts from RTP implementation will be estimated as follows:

a. For each RTP alternative, the construction-caused loss of business revenue, business tax loss, and the primary and secondary income and income tax impacts on the economy of the area will be estimated.

The methodology used to make estimates of rapid transit construction-caused impacts on local businesses will include:

- Identification of the businesses located within the RTP corridors most likely to be affected by rapid transit system construction.

- Establishing factors for construction-caused business loss (by type of business and for alternative rapid transit system construction modes) through analysis of case studies of completed similar projects, including the Downtown Seattle bus tunnel.

- Applying loss factors to the businesses identified as susceptible to construction impacts to estimate revenue loss. Employment of multiplier rates to estimate secondary business impacts.

- Applying relevant tax rates to estimate business tax losses.

b. Estimates will be made of the employment impacts (including both directly created jobs and indirectly generated jobs arising from the multiplier effect of wages and salaries) associated with construction and operation of the proposed facilities.

   Metro-prepared estimates of employment related to construction and operation of the proposed RTP facilities will be used. Indirect employment will be estimated through application of multipliers developed from the analysis of other rapid transit projects.

c. Estimates of the increase in local tax revenues generated in connection with:

   - Construction expenditures
   - Operating expenditures.

d. Use of Metro-prepared estimates of RTP construction and operating expenditures to estimate incremental business revenues, new retail spending, and other new tax sources for each alternative. Application of the appropriate tax rates to estimate incremental local tax revenues.

The potential for economic development in the RTP corridors will be assessed as a result of the various alternatives and compared to the No-Build scenario. Potential new revenue sources will be identified that could result from development around the stations. Increases in sales and property tax revenues as a result of new development will be estimated. The net increase in the cost of providing infrastructure and services to support potential new station area development will be estimated.

1.1.4 Documentation

Presentation of the land use and economic development information will be in narrative format, maps and tabulations. A matrix may be used to concisely explain data relationships and/or impacts with each RTP alternative.

The audience for the documentation is primarily technical, including FTA and the Regional Transit Project Technical Forum. The technical documentation will be edited as necessary for general audiences in the Environmental Impact Statement.

1.2 NEIGHBORHOODS

1.2.1 Introduction

Major transit capital investments affect neighborhoods both positively and negatively. A neighborhood analysis will be developed in order to focus the transit analysis and impacts to a micro-scale neighborhood level so that effects to neighborhoods/neighborhood cohesion can be identified, and appropriate mitigation measures developed. Potential impacts as a result of the implementation of a transit investment exist in the following areas:

- Displacement
- Relocation
- Neighborhood cohesion
- Community facilities
- Access to community facilities and services
- Neighborhood quality and lifestyles.

1.2.2 Baseline

The baseline inventory will consist of identifying neighborhood characteristics with the assistance of the public involvement process, local knowledge of the project, input from neighborhood groups, input from the affected municipalities within each corridor, and input from representatives of King, Pierce and Snohomish Counties and PSRC. Some of this information will be qualitative rather than quantitative in nature; however, where possible, the following characteristics will be quantified by neighborhood and/or planning district for both the base and horizon year:

- Population
- Number and type of housing units
- Income characteristics
- Racial characteristics
- Employment

In order to provide an indicator of neighborhood susceptibility to economic pressures, information will be obtained on the distribution of housing units by market value (according to the HUD criteria for low and moderate income levels).

Census tracts and planning districts identified by the planning departments of local jurisdictions that border the three corridors will serve as the basis for definition of neighborhood boundaries. Where appropriate, public school attendance boundaries may be utilized to define neighborhood boundaries.

1.2.3 Impact Assessment and Mitigation

When the neighborhoods have been identified and mapped, the transit alternatives will be overlaid to ascertain the impacts of construction and/or operation of rapid transit facilities. Where possible, displacements (if required) will be tabulated by planning district. The analysis will also identify the degree of incursion or disruption (i.e., noise, zoning, traffic, safety, recreation, employment opportunities, shopping) in any impacted neighborhood, and whether or not any of the alternatives split a neighborhood in a way that would create a barrier or affect its identity. Additionally, neighborhoods that potentially could undergo character change as a result of induced development near transit station locations will be

identified and rated (by the estimated magnitude of change) as low, moderate or high based on discussions with local land use authorities.

Where there are foreseeable impacts, the assessment will discuss mitigation for the following items, for each alternative, commensurate with the level of impacts:

a. Changes in the neighborhoods or community cohesion for the various social groups as a result of the proposed action. These changes may be beneficial or adverse and may include splitting neighborhoods, isolating a portion of a neighborhood or an ethnic group, generating new development, or separating residents from community facilities, etc.

b. Impacts resulting from the displacement of households and businesses.

c. Changes in travel patterns and accessibility.

d. Impacts on school districts, recreation areas, churches, businesses, police, and fire protection, and other social services. This will include both the direct impacts to these entities and the indirect impacts resulting from the displacement of households and businesses.

e. General social groups benefitted or harmed by the proposed project. The effects of a project on the elderly, handicapped, non-drivers, transit-dependent, minority, and ethnic groups will raise particular concerns and will be described to the extent these effects can be reasonably predicted.

f. Impacts on the various environmental aspects of the neighborhood that contribute to the general quality of life (i.e., noise, zoning, traffic, safety, recreation, employment opportunities).

1.2.4 Documentation

The results of the neighborhood analysis will be presented in narrative, supplemented with tables and figures which illustrate the baseline, impact findings, and recommended mitigation by neighborhood and/or planning district.

1.3 DISPLACEMENT/RELOCATIONS OF EXISTING USES

1.3.1 Introduction

This task shall describe the methodology for the quantification of the displacement of existing land uses as a result of the construction and operation of rapid transit facilities. Also, where displacements will likely occur, the methodology describes how replacement locations for residential/employment uses will be identified, and the impacts of the relocation assessed, including the associated costs.

1.3.2 Baseline

Establishment of the baseline for this analysis occurred in the preceding tasks of 1.1 Land Use and Economic Development and 1.2 Neighborhoods.

1.3.3 Impacts and Mitigation

The displacements of residences, businesses and other land uses will be estimated as accurately as possible through the comparison of aerial photography and planned land use changes to conceptual engineering drawings of the RTP alternatives in each corridor. An analysis of impacts and mitigation will include the following:

a. An estimate of displaced residential and business units by type will be made by project segment or area. The analysis must also consider yet-to-be completed projects by zoning class for which local governments have issued permits and obtained or made financial commitments.

b. Partial impacts, considered as minor property takings that do not alter the primary use, will also be estimated by type of use.

c. Public facilities that will be displaced or otherwise affected will be identified.

d. Based on U.S. Census data by planning area, field-observed/planned densities, real estate management consultation, and average employment by area/land use type or other data; estimates will be generated of the number of households, household members, businesses, employees and other individuals potentially displaced by each alternative.

e. The characteristics of the displaced households will be appraised from 1990 Census data by planning area as adjusted for adopted plans for the future planning horizon. Depending on the availability of the necessary data, consideration will include race, income, tenure, age and family size of affected households.

f. The availability of comparable replacement housing or business space will be identified through comparisons of vacancy rates, real estate sale comparisons and the advertised costs of rentals by subarea.

g. The count of displaced and partially affected residents and businesses will be utilized in conjunction with typical relocation settlement data from previous public sector projects in the Puget Sound region to generate estimated costs of displacement and relocation for each alternative.

h. The availability of relocation assistance from Metro and other organizations will be identified and commitments to last-resort housing provided consistent with the Federal Uniform Relocation Assistance Act.

1.3.4 Documentation

Displacement/relocation information will be documented by planning district or project segment and alternative in order to accommodate revisions in alignments within corridors. The documentation will include narrative analysis supplemented by aerial photography, plat maps, or other mapping and matrix type tables by geographic subarea.

1.4 VISUAL QUALITY AND AESTHETIC RESOURCES

1.4.1 Introduction

This task will provide a description of the existing visual and aesthetic resources and potential impacts to visually sensitive areas within each of the corridors as a result of the construction and operation of RTP alternatives.

1.4.2 Baseline

To establish a baseline of existing visual and aesthetic conditions, the following will be determined:

a. Describe and document the visual and aesthetic resources of each corridor. Concentrate on the areas where alignment alternatives within each corridor could impact the visual quality of greenbelts and residential areas. Specific visual and aesthetic resources include features of natural and built environments such as existing development, landmarks, and landscapes. These resources also include areas of special visual or design character, patterns or systems of open space (parks, recreation areas, and wetland/wildlife habitats), individual buildings, landmarks or clusters of development with aesthetic or historic value, and major views or vistas which may be affected by corridor alignments.

b. Visual field surveys using urban design notation techniques will be conducted on foot or from an automobile to identify the general location and character of visual and aesthetic resources. Sensitive or affected areas will be identified using various graphic means (video technology, 35mm photography, or line drawings to show cross sections and/or perspective views). Aerial photographs prepared for Metro or any other existing city and county aesthetic inventory may be used.

c. The relative importance of visual and aesthetic landmarks will be classified as major, moderate, or minor. For instance, Mount Rainier, the Olympic Mountains, Puget Sound, or the Seattle skyline would be considered major visual and aesthetic landmarks. From specified points along each corridor, visual and aesthetic impacts will be identified relative to different land use types. In existing undeveloped or developing areas, current land use plans will be utilized to identify future land use types at typical or sensitive corridor locations.

1.4.3 Impact Assessment and Mitigation

Based on data concerning existing conditions, the alternatives within each corridor will be analyzed relative to potential visual and aesthetic impacts. Mitigation measures will be identified to address intrusion, views, compatibility, and unity. The analysis will include the following tasks:

a. Evaluate the potential visual impacts of candidate vehicle technologies and equipment requirements (e.g., tracks, overhead wires, etc.) in relationship to existing visual qualities within each corridor. The degree and character of tree and vegetation removal associated with each alternative shall be depicted graphically for each alternative. Media techniques such as photo montage or video technology will be used to illustrate the visual impacts of proposed alternative vehicle and passenger facilities, including elevated structures and overhead wires.

b. Assess visual and aesthetic impacts from at least two viewpoints; 1) From adjacent land uses, and 2) From the perspective of the rapid transit system user.

c. For each corridor, recommend potential mitigation measures to screen rapid transit facilities from sensitive areas, reduce obstruction and/or enhance the transit user experience. Suggest changes in facility alignment within corridors (horizontal and/or vertical), as appropriate.

d. Evaluation criteria for impact assessment and mitigation treatments will include:

- Intrusion: Where a visual and aesthetic resource is impacted and loses a part of its visual quality (spatial security or loss of openness) due to a transit facility alignment (vehicles and/or equipment) in terms of location and size.

- Views: Where a view to a visual and aesthetic landmark or views within a land use type are obstructed due to a transit facility alignment.

- Compatibility: Where the character and context of a visual and aesthetic resource is impacted in terms of color, shape, texture, details and other features.

- Unity: How vehicle technologies and equipment provide a consistent and unified corridor-wide or system-wide image (facility design consistency, art, architecture) affects the general character of visual and aesthetic resources.

The following visual and aesthetic issues of special concern will be addressed in the assessment:

- East Corridor Alignments: The entrance to Bellevue through the sensitive Mercer Slough area, including ramps from I-90 to I-405. Urban design context of downtown Bellevue, especially Bellevue Square, the Bellevue Transit Center and the pedestrian corridor. Aerial guideway north and east from Bellevue through Overlake to Redmond. Redmond area station development.

- North Corridor Alignments: Urban design contextual impacts to the University of Washington Campus, busway ramps from I-5 at 45th, and station development on First Hill, Capitol Hill and in the Roosevelt area.

- South Corridor Alignments: Impacts on semi-rural landscapes in the Duwamish Valley the Green River Valley and other areas. The Rainier Valley and the Columbia City Historic District.

For each corridor, construction impacts will be assessed, especially impacts from station development and from light and glare during construction.

1.4.4 Documentation

Baseline Assessment

Figures and/or tables will be provided to illustrate the general location, importance and character of visual features and aesthetic resources for each corridor.

Figures will be provided to depict visual features and aesthetic resources relative to different land use types (e.g., existing/future residential, commercial, parks) for each corridor.

Impact Assessment and Mitigation

Figures will be generated to represent the impacts and mitigation measures for visual features and aesthetic landmarks for each rapid transit facility alignment within the corridors; such figures will consider the impacts and mitigation relative to different land use types within the corridors.

1.5 HISTORIC, ARCHAEOLOGICAL AND CULTURAL RESOURCES

1.5.1 Introduction

Historic, archaeological and cultural resources affected by federally-assisted transit projects are protected under two statutes with slightly different, though related, provisions.

Section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. 303) requires a finding by the United States Secretary of Transportation that no prudent and feasible alternative exists to any federal action that has negative impacts on properties and areas covered by the Act, and that all possible planning has been done to minimize harm. In addition to significant publicly-owned parklands, recreation areas, and wildlife and wildfowl refuges, the statute protects both publicly and privately owned historic sites. Section 4(f) applies to historic sites listed in or eligible for listing in the National Register of Historic Places as well as those determined significant under state and local preservation laws.

Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f) requires that federal agencies identify and assess the effects of federal undertakings on historic properties, which include districts, buildings, structures, objects, traditional cultural properties and archaeological resources. Agencies must consult with the State Historic Preservation Officer (SHPO) and other interested parties to find acceptable ways to avoid or mitigate adverse effects on historic properties and/or areas of archaeological significance. Agreements on measures to avoid or reduce harm then face review and comment by the Advisory Council on Historic Preservation (ACHP). Properties covered by Section 106 include those listed in or eligible for listing in the National Register of Historic Places.

1.5.2 Baseline

To establish a baseline of existing historic, archaeological and cultural resources, the following will be determined:

- Using standardized base maps, the areas of potential effects will be clearly demarcated in relation to each of the three corridor alternatives. Particular consideration will be given to alternative alignments within the corridors; locations of transit centers and park-and-ride lots; areas where visual, audible or atmospheric changes could occur; areas where modified traffic patterns might affect the livability or commercial viability of historic districts; and areas of proposed tunnel boring, where a potential exists for disturbing archaeological resources.

- Identification of potential and existing National Register properties, and existing local historic districts and designated landmarks. The pre-urban natural landscape will be examined in order to identify areas which may contain buried prehistoric and historic archaeological remains. Efforts to identify and evaluate resources will follow the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716 et seq.).

Early coordination with the SHPO will occur to review and consider recommendations regarding identification methods and priorities.

Historic Properties

- A descriptive list of known sites within the study area will be compiled utilizing the records of the Washington State Office of Archaeology and Historic Preservation (OAHP). This list will include properties listed in the National Register of Historic Places, those already determined eligible for the National Register through previous review, and properties listed in the State Register or entered in the state inventory.

- Coordination with municipal historic preservation authorities will provide information on designated city landmarks and site locations of properties identified by local survey activities. Local authorities include the Seattle Office of Urban Conservation, the Tacoma Landmarks Preservation Commission, the Bothell Landmarks Preservation Board and the Everett Historical Commission.

- Records of the King County Historic Preservation Program and the Pierce County Landmarks Commission will provide information on designated county and community landmarks, and properties that have been researched and entered in the county inventory. It must be noted that the King County survey is ongoing and that the Snohomish County inventory includes National and State Register-listed resources only. Appropriate member organizations of the Association of King County Historical Organizations (AKCHO) will be contacted for information that may lead to identifying potentially historic properties.

- Following the compilation of this material, a field check will be undertaken to assure that all listed properties retain eligibility and have not suffered loss of integrity. A field investigation of areas not yet surveyed will also be completed.

- During alternative analysis, properties identified in the field investigation need evaluation using National Register and local landmark criteria. However, site requirements, such as the preparation of Request for Determination of Eligibility forms, will only be undertaken when final Section 106 documentation and the Section 4(f) statement are being prepared.

- All existing and potential National Register properties and local historic districts and landmarks within the RTP corridors will be identified and mapped to illustrate their relationship to proposed rapid transit alternatives.

Archaeological Resources

- Data will be collected on the pre-urban natural environment from historic maps and atlases, topographic maps, and early photographs. Washington State files of known archaeological sites will be reviewed.

- A reconnaissance survey will provide a preliminary basis for documenting all potentially undisturbed areas within the RTP corridors which may contain previously unrecorded sites. Limited subsurface testing will be undertaken.

- The location of known and potential archaeological resources will be mapped to identify and assess relationships to each RTP alternative.

Traditional Cultural Properties

The state files of known traditional cultural properties will be reviewed. Representatives of appropriate Native American tribes and ethnic communities will be consulted. A reconnaissance survey for each RTP corridor will be conducted to identify previously unidentified properties. Locations of known properties can then be mapped to identify and assess their relationship to each rapid transit alternative.

1.5.3 Impact Assessment and Mitigation

To analyze each proposed rapid transit facility, impacts will be assessed on a preliminary basis relative to the nature of severity of the likely impact. Particular attention will be given to impacts on identified resources on the University of Washington campus, in the University District, north Capitol Hill, First Hill, Rainier Valley, Duwamish River and Black River vicinity, the Mercer Slough area and downtown Redmond.

The assessment of impacts will include an examination of alignment variations and other design alternatives that might avoid the direct physical taking of historic properties, archaeological resources or traditional cultural properties. Other actions to minimize harm and possible mitigative measures need examination. Impacts require analysis and mitigation measure development in consultation with the SHPO and other appropriate organizations, including local government agencies, preservation organizations, local historical societies, and Native American tribes.

The final analysis will follow procedures outlined in the ACHP regulations that implement Section 106 (36 CFR Part 800), and as set forth in Federal Transportation Agency (FTA) procedures for Section 4(f) as published in 23 CFR Section 771.135. Criteria of effect and adverse effect will be applied to all historic properties and archaeological resources for each alternative. The completed impact analysis and mitigation measures will provide some of the requisite material for Section 106 documentation and the Section 4(f) statement.

1.5.4 Documentation

Baseline

The baseline assessment of historic, archaeological and cultural resources will describe completed research and investigations, and summarize historical and archaeological data. The report will contain figures illustrating the generalized locations of all historic properties and archaeological and cultural resources. Federal and state laws prevent public disclosure of archaeological site locations; therefore, sensitive information will not be released without prior FTA approval. Brief descriptions of all historic, archaeological and cultural resources for each corridor will include significance, access, current use, and alignments, station area sites, park-and-ride lots, and other facilities.

Impact Assessment and Mitigation

The EIS will describe likely impacts on identified historic properties and archaeological resources. The assessment of these impacts and identification of mitigation measures will reflect consultation with the State Historic Preservation Officer and other appropriate agencies and organizations.

1.6 PARKLANDS

1.6.1 Introduction

The analysis will be based on the requirements identified in Section 4(f) of the United States Department of Transportation Act of 1964. Parklands covered under Section 4(f) include publicly owned parks, recreation areas and trails, open spaces and wetland and wildlife habitats. In addition to parklands as required by Section 4(f), the affects of rapid transit alternatives will also be evaluated on agricultural lands and other privately held open space.

1.6.2 Baseline

To determine baseline conditions, all parklands, recreation areas, open spaces, and wildlife refuges within each corridor must be identified by size (in acres), characteristics, (visual; available facilities; function, e.g. neighborhood, regional, etc.) use, ownership and location.

Early coordination will be established with parks agencies such as Washington State Parks and Recreation Commission, King County Natural Resources and Parks Division, Pierce and Snohomish County Parks and Recreation Departments and municipal parks and recreation departments and other local government agencies to assure a comprehensive and accurate list of potentially affected parklands. In addition, planned improvements to existing parklands and the development of new parklands, based upon the most current available plan (or to a horizon year of 2010) require identification. Visual qualities of existing parklands in proximity of rapid transit alignment locations will be recorded using video technology and 35mm photos. These recorded media will be utilized later to develop computer-simulated images of existing and future conditions which will illustrate the relative locations of parklands and rapid transit alignments.

1.6.3 Impact Assessment and Mitigation

The impact analysis will identify those parkland areas which have been determined to be significantly impacted by the construction and/or operation of rapid transit facilities. The extent of impacts relative to existing and future uses will be determined based upon the degree of physical intrusion, loss of intended usability and compatibility.

<u>Intrusion:</u> Where a parkland loses acreage or suffers visual intrusion.

<u>Usability:</u> Where a parkland loses its intended function as well as the loss of individual facilities.

<u>Compatibility:</u> Where rapid transit facility location conflicts with the usage, access, integrity and other features of the parkland.

Mitigation options to minimize parkland impacts will include avoidance by re-alignment. Where impacts are unavoidable, mitigation options will include actions to minimize harm

by changing the vertical profile of the transportation facility, providing berms or buffers and by providing parkland replacement.

1.6.4 Documentation

The documentation of the parklands analysis will include descriptive text on the resources; positive and negative effects by the construction and operation of alternative rapid transit improvements; and mitigative measures to reduce negative effects. Text will be supplemented with the following items:

- Tables showing existing/future parklands and improvements (size, characteristics, ownership).
- Figures illustrating the locations of existing/future parklands.
- Tables showing size, characteristics, and ownership impacts relative to RTP alternatives.
- Figures illustrating size and locational impacts relative to RTP alternatives.
- Computer-simulated images/figures illustrating mitigation measures for existing/future parklands.

1.7 TRANSPORTATION FACILITIES

1.7.1 Introduction

The purpose of the transportation facilities analysis task is to present the transportation consequences of each of the alternatives including transit service levels, patronage forecasts, travel benefits and traffic impacts. The level of detail of analysis will be appropriate for comparing among the alternatives (versus a level of detail appropriate for design).

1.7.2 Baseline

Many of the measures that will be used for comparing among alternatives are system or corridor performance measures which will come directly out of the transportation modeling process including service levels and patronage numbers. However, the more detailed analysis necessary to evaluate impacts at or near proposed guideway station locations will require traffic volumes at a more micro level of detail than is typically coded into the regional model. In order to produce these volumes, a more detailed street and highway network will be coded, where necessary, in the vicinity of potential transit stations.

The baseline against which the TSM and Build Alternatives will be evaluated will be the No Build Alternative.

1.7.3 Impact Assessment and Mitigation

Transit impacts and traffic impacts of rapid transit system construction and operations will be addressed. The analysis of transit impacts will assess the level of service and patronage forecasts for each alternative. The following methodology will be used:

- Level of Service - A description of the facilities and service provided by each RTP alternative will be prepared stressing the differences among alternatives. The service level analysis will include three components: 1) a focused examination of differences in transit accessibility from all zones to a selected set of activity centers; 2) development of frequency distributions of regional person trips versus the differences in transit service between the RTP alternatives; and 3) a "winners and losers analysis" to isolate the trips whose transit service is less attractive with each RTP alternative and identify transit operating improvements that will improve the transit service for those trips.

- Patronage - The patronage assessment will include a description of the projected travel markets and the changes in transit travel/ridership expected with each RTP alternative.

The analysis of traffic impacts will include measures for assessing differences in the traffic impacts of each RTP alternative relative to the No-Build. Measures that may be developed include:

- Reductions in auto vehicle trips
- Changes in auto and bus vehicle miles of travel
- Number of lanes/right-of-way taken by an alternative
- Changes in vehicle occupancies
- Levels of congestion across major screenlines or by link
- Circulation and congestion impacts near proposed guideway stations
- Impacts associated with terminus stations
- Impacts on parking demand both in central business districts and at park-and-ride lots

For those measures which do not come directly out of the model, such as circulation and congestion impacts near proposed guideway stations, additional analyses will be performed to develop approach volumes at critical intersections and to estimate whether intersections will be under, at, or over capacity under the various alternatives. Existing traffic count information will be assembled for these station areas. The following will be applied in analyzing station-area impacts:

1) Base and No-Build traffic assignments to compute the traffic growth factors that will be applied to existing traffic volumes.

2) Manual assignments of drive-access trips to highway links approaching the stations.

3) Manual assignments of bus volumes to these highway links.

4) Spreadsheet-based analysis of traffic service levels.

Likely impacts on station area traffic circulation and traffic operations will also be evaluated. Station locations will be identified for which further analysis of mitigation measures may be necessary in preliminary engineering.

1.7.4 Documentation

The results of the transportation analyses will be documented in a technical report and in a summary suitable for inclusion in the Draft EIS. The technical report will include a description of existing and future no-build conditions as well as the transit and traffic impacts under the TSM and build alternatives.

1.8 UTILITIES

1.8.1 Introduction

The purpose of this task is to identify energy, communications, water, sewer, solid waste, and storm water facilities that could be adversely affected due to construction or operation of the RTP alternatives and to describe appropriate mitigation for potential impacts.

1.8.2 Baseline

Existing utility facilities on or adjacent to RTP rapid transit alignments will be identified. Capacity of utility services to areas around proposed stations and plans for future expansion will be evaluated.

Specific tasks include:

a. Identify and contact all operators of public and private utilities in the corridors under study. Operators to be contacted include local jurisdictions, providers of retail and wholesale electric power, providers of natural gas, telephone communication systems, water districts, and sewer districts. Efforts will be made to identify specialized fuel pipelines serving industrial areas, airfields, and the like, and specialized communications networks used by fire departments and other public agencies.

b. Secure documentation of existing utilities and plans for future expansion within 1/4 mile of proposed rapid transit facilities. Describe and map utility alignments in relation to proposed rapid transit facilities.

1.8.3 Impact Assessment and Mitigation

Potential impacts on utilities associated with each of the RTP alternatives will be identified. Both direct impacts, due to construction of rapid transit facilities, and indirect impacts, due to increased development around station areas, will be identified. Finally, mitigation measures will be discussed.

Direct impacts could include physical intrusion on utility rights-of-way, requiring design changes or utility relocation; damage to pipes due to ground settlement or inadvertent excavation during construction; and damage to storm drainage systems due to sedimentation caused by construction.

a. Physical intrusion will be evaluated by comparison of preliminary horizontal and vertical alignments for rapid transit facilities with locations of present and planned utility facilities. In cases where rapid transit facilities would lie close to but not cross utility facilities, the potential for disruption due to construction staging, excavation, or grading would also be evaluated.

b. Potential damage due to ground settlement will be evaluated in areas where ground settlement during pile driving and other construction is likely to occur.

c. Storm drain systems infalls vulnerable to sedimentation during construction will be identified and the potential for damage evaluated.

Indirect impacts will be evaluated by estimation of increased demand for energy, natural gas, water, sewer service, and telephone service, as well as increased flows in storm water facilities caused by local development induced by siting of a station in an area. These increased demands will be evaluated in the context of regional and local increases in demand not specifically due to rapid transit stations.

Mitigation for direct utility impacts will include changing the design of rapid transit facilities to avoid impacts, replacement of utilities after construction of facilities, and relocation of utility lines to comparable corridors. The implications of each type of mitigation for the affected utility will be discussed along with means to minimize interruptions to utility service.

1.8.4 Documentation

Existing and planned utility alignments near proposed rapid transit facilities will be mapped and described in narrative form. Discussions with utility providers will be referenced. Assumptions for calculation of utility demand in station areas will be described in the text.

2.0 PHYSICAL ENVIRONMENT

2.1 SOILS, GEOLOGY AND SEISMIC SETTING

2.1.1 Introduction

Construction and operation of the proposed transit system may impact the geologic conditions in the vicinity of construction. These impacts will be identified and assessed, and mitigation measures will be recommended to minimize or compensate for them.

Impacts to surface water and ground water flow, as well as water quality are addressed in Section 2.3. Impacts to soils and geology due to the presence of environmentally hazardous materials are discussed in Section 2.7.

2.1.2 Baseline

Existing baseline information of the soils, geology, and seismic setting will be collected from a variety of local, state, and federal agencies. Much of this data is available in the form of geologic maps. Additional subsurface information will be obtained from the public records of explorations conducted in the area, and from previous construction activities. In addition to government agencies, similar information will be sought from private landowners along the potential alignments.

Baseline information will be collected and added to the database as additional subsurface information is obtained through explorations made for the project design.

2.1.3 Impact Assessment and Mitigation

The impacts of the proposed transit system will be assessed through discussions with the design team consultants as well as the appropriate local, state, and federal agencies. Options for mitigation measures will be identified and assessed. Measures to provide compensation for unavoidable adverse impacts will also be developed.

2.1.4 Documentation

A report will be prepared that presents the baseline conditions for soils, geology, and seismic setting; identifies and assesses the impacts that the proposed transit system might have on the existing conditions; and presents options and recommendations for mitigation measures or alternatives for compensation. Maps and cross-section figures will be prepared to graphically illustrate the baseline conditions and potential impacts.

2.2 ECOSYSTEMS (TERRESTRIAL/AQUATIC)

2.2.1 Introduction

The proposed transit system could potentially affect aquatic and terrestrial resources by placing fill into wetlands, removing or disturbing natural plant communities, displacing wildlife, or disrupting a sensitive area. These potential impacts will be identified and mitigation measures recommended to compensate for those impacts deemed adverse.

2.2.2 Baseline

Terrestrial Ecosystems

Existing baseline information will be collected from various local, state and federal agencies. Through the use of current and historic records of natural plant communities, locally important plants and animals, and special concern species maintained by several different agencies, a comprehensive baseline inventory of known resources within the proposed corridors will be compiled. Once completed, this information will be updated and verified through a field evaluation of each RTP alternative. Any new or revised information will be reviewed with the appropriate agencies. The following potential sources of information will be consulted:

a. The Washington Natural Heritage Program maintains a database concerning rare plants and high quality plant communities.

b. The Washington State Department of Wildlife has information on 180 different "special concern" species whose habitat may be within or adjacent to the RTP alternatives.

c. The King County Sensitive Areas Map Folio will be utilized to identify sensitive ecological areas within the unincorporated King County portions of each RTP alternative. This will be supplemented by other sensitive area inventories where available from local jurisdictions, including the Snohomish County Wetlands inventory.

d. A list of common wildlife and wildlife habitats will be compiled through the use of aerial photography, coordination with the U.S. Fish and Wildlife Service and the Washington State Departments of Ecology, Wildlife and Natural Resources, local inventory data, and through site surveys.

Aquatic Ecosystems

Wetlands, lakes and streams within each corridor will be identified initially through maps from the U.S. Fish and Wildlife Service, the King County Wetlands Inventory Notebook, and sensitive area maps (published or unpublished) from local jurisdictions. This

information will be field verified, and approximate wetland boundaries will be determined and reviewed with the appropriate agencies. The following tasks will be undertaken to complete this analysis:

a. Identification of high quality native wetland communities through the Washington Natural Heritage Program. Wildlife and special concern species associated with wetland areas will also be identified through coordination with the appropriate agencies.

b. Categorization of wetland communities using the Cowardin classification system as employed by the U.S. Fish and Wildlife Service on the national Wetland Inventory maps. The function of each wetland within the study area will be determined as well as their size using an electronic planimeter.

2.2.3 Impact Assessment and Mitigation

Impacts to sensitive areas within aquatic and terrestrial ecosystems will be identified in the baseline inventory process. Potential construction limits will be estimated for each RTP alternative and used to define impacted areas. Affects on wetlands and other plant communities will be relative to the identified functions of the wetlands and the levels of physical disturbance. Impacts to wildlife and special concern species will be assessed in terms of critical habitat losses and migration corridors.

Options for mitigation measures for ecosystem impacts will be identified and discussed with the appropriate local, state and federal agencies. Means to avoid and/or minimize the identified impacts will be studied and alternatives suggested. Mitigation measures will also be developed to compensate for unavoidable ecosystem impacts.

The various applicable local, state, and federal regulations concerning ecosystem resources will be identified and discussed relative to permit requirements.

2.2.4 Documentation

Figures and text will identify and describe the baseline conditions and locations of plant communities, special concern animal species, sensitive ecological areas, and wildlife habitats. Maps will indicate the locations of any wetlands on which alternatives encroach. Ecosystem impacts and potential mitigation measures will be described and illustrated relative to each RTP alternative. Coordination with the different agencies will also be documented. The Final Environmental Impact Statement will include a "wetland finding" to document the project's conformity with applicable regulations.

2.3 WATER QUALITY AND HYDROLOGY

2.3.1 Introduction

Construction and operation of the proposed rapid transit facilities could adversely impact water resources through increased surface water runoff, degradation of the quality of runoff and encroachment into floodplains. Groundwater flow and quality could also be affected. This task will describe the existing hydrological systems and document current ground and surface water quality. It will discuss potential adverse impacts on surface water runoff and groundwater resources, and means of mitigating these impacts.

2.3.2 Baseline

Surface Water Resources

All surface water bodies (i.e. rivers, lakes) that could be affected by the project will be identified. Quality data for each water body will be obtained from sources such as the U.S. Geological Survey (USGS), Washington Department of Ecology (Ecology), King County Surface Water Management Division (SWM), and Metro. RTP corridor areas that fall under the provisions of the Shoreline Management Act (SMA) will also be identified.

Surface Drainage and Floodplains

The drainage areas for each affected watershed will be delineated on USGS topographic maps. Based on information from the Washington State Department of Transportation and the U.S. Army Corps of Engineers, drainage facilities will be located, described, and field verified. Floodplain locations relative to each RTP alternative will be delineated based on floodplain maps from the Federal Emergency Management Agency (FEMA).

Ground Water Resources

Groundwater quality data, such as depth to groundwater and direction of groundwater flow, will be obtained from local water districts, Washington State Department of Health, the USGS and Ecology.

2.3.3 Impact Assessment and Mitigation

Surface Water Resources

The impacts of construction on surface water quality will be assessed through review of runoff water quality studies and compared to state and federal standards. Such studies have been conducted by the Washington State Department of Transportation and others. Impacts on the quantity of surface runoff will be evaluated for each RTP alternative using techniques developed by the U.S. Soil Conservation Service (SCS), as described in "Urban Hydrology for Small Watersheds" (SCS Technical Release 55). Methods of mitigating surface water quality and quantity impacts will be described.

Requirements of local Shoreline Master Programs (SMP) created under SMA will be described and methods of meeting these requirements evaluated.

Surface Drainage and Floodplains

Each of the RTP alternatives will be plotted on FEMA floodplain maps to locate areas of encroachment on the floodplain and drainage facilities. The effects of encroachment by the alignments and means of mitigating the effects will be discussed.

Groundwater Resources

The runoff water quality data used to evaluate impacts on surface water will be used, in conjunction with hydrogeologic maps, to determine possible impacts on groundwater quality. If tunnels are required for transit facilities, the potential impacts on groundwater flow will be evaluated qualitatively.

2.3.4 Documentation

A technical report will be prepared that presents current ground and surface water data, surface drainage and floodplain locations, possible impacts, and mitigation measures. Figures will be prepared illustrating drainage areas, drainage structures, and areas of floodplain encroachment by the RTP alternatives.

2.4 NOISE AND VIBRATION

2.4.1 Introduction

An analysis of the noise and vibration impacts of the RTP alternatives will be conducted consisting of the following general steps:

a. Identify noise-sensitive receiver sites in the vicinity of RTP alternatives.

b. Characterize the existing noise environment.

c. Estimate levels of noise and vibration associated with the rapid transit vehicles and associated support facilities such as maintenance yards, ventilation fans (tunnel stations), and similar equipment.

d. Evaluate the physical relationship between rapid transit facilities, receiver sites, and natural and man-made features that will affect noise or vibration transmission.

e. Estimate future noise levels at sensitive receiver sites.

f. Identify potential vibration impact areas.

g. Compare predicted noise levels to established standards and criteria using both absolute criterion and the relative approach to identify and evaluate potential impacts.

h. Identify the width of the noise impact corridor and zones related to the degree of effect.

i. Upon identification of potential impacts, evaluate alternative means of noise and vibration mitigation.

j. Estimate noise and vibration levels associated with project construction activities and evaluate their significance.

k. Identify mitigation measures to minimize construction impacts.

2.4.2 Standards and Criteria

Noise impacts will be evaluated based on design guidelines published by the American Public Transit Association and procedures specified in FTA's *Guidance Manual for Impact Analysis of Transit Noise and Vibration*. The analysis will evaluate noise impacts in terms of the following three noise descriptors: 1) the maximum sound level reading in decibels sampled during a test or estimated from comparably-specified equipment, (L_{max}); 2) the mean sound level in decibels for a given period of time, (L_{eq}); and, 3) day-night average in decibels, consisting of the 24-hour average sound level after the addition of 10 decibels to

sound levels between the hours of 10 p.m. and 7 a.m. (Ldn). Local noise standards and criteria will also be reviewed and documented, including the City of Seattle Noise Ordinance, which stipulates maximum noise levels for construction and other activities.

2.4.3 Baseline

Sensitive Receivers

Noise and vibration sensitive receiver sites within 1,000 feet of the RTP corridors will be identified and categorized. Land uses will be identified using existing inventories, field surveys, and aerial photography. Land use categories will include the following:

a. Residential buildings, parks and other uses where quiet is essential.

b. Other buildings of a residential character intended for overnight sleeping, including residential care/treatment facilities and in-patient medical facilities.

c. Institutional facilities with primary daytime usage including schools, churches, and libraries.

d. Special vibration sensitive uses including research facilities, sensitive industrial processes, laboratories, and others.

Existing Noise Levels

Noise monitoring will be conducted at representative sites in each corridor in order to characterize the existing noise environment. Monitoring sites will be selected to include a variety of land use types and transit corridor relationships. Existing sources of noise and vibration data will be documented as available.

2.4.4 Impacts and Mitigation

Noise associated with transit operations will be estimated using the methodology described in FTA's *Guidance Manual for Impact Analysis of Transit Noise and Vibration*. The noise impact analysis will consider the physical relationship between the transit noise source and the receiver sites including the presence of physical features such as retaining walls, bridges, slopes, etc.

Transit generated noise will be compared to existing noise levels and applicable standards by land use type to determine impacts. If impacts appear, noise mitigation measures will be identified. Such measures will consider noise source controls which can be incorporated into the transit system design, noise path controls such as barriers or berms, and noise receiver controls. The feasibility and effectiveness of alternative mitigation measures will be evaluated.

Vibration impacts will be addressed by estimating the physical extent of effects relative to vibration sensitive land uses. This evaluation will use existing sources of data to characterize transit system vibration levels and likely ground-borne vibration transmission characteristics. Where impacts are indicated, vibration control measures will be identified.

Construction generated noise and vibration impacts will be documented based on expected construction activities and the relationship to sensitive receiver sites. Construction noise control measures will be identified.

2.4.5 Documentation

Maps will be prepared to show noise sensitive receiver sites, noise monitoring sites, and graphically portray the extent of project related noise impacts using noise contour maps or similar graphic techniques. Noise and vibration standards and criteria, the prediction methodology, and procedures to identify impacts will be discussed in text. Alternative mitigation measures will be documented.

2.5 AIR QUALITY

2.5.1 Introduction

The air quality analysis will identify the regional and local impacts on air quality resulting from implementation of the RTP alternatives. The air quality analysis will document the following:

a. Existing air quality conditions and designations in the region and the alternative corridors.

b. Pertinent air quality trends over the planning forecast period, particularly in regard to vehicle miles travelled, related air pollutant emissions, and the conformity requirements of recent federal and state legislation (1990 Clean Air Act Amendments and 1991 State Clean Air Act).

c. Potential effects to air quality resulting from construction of the RTP alternatives.

d. The change in the pollutant burden of the region associated with the operation of the RTP alternatives.

e. A microscale evaluation of the local impacts on carbon monoxide (CO) concentrations in the vicinity of station sites, park-and-ride lots and known critical intersections which could be affected by proposed rapid transit system improvements.

f. Air quality mitigation measures as needed to address identified air quality impacts of the project.

2.5.2 Baseline

Existing sources of data will be used to characterize the baseline air quality of the region and the RTP corridors. Climatic characteristics of the Puget Sound area as they relate to air quality will be documented. Existing air quality conditions and trends will be chronicled using pollutant monitoring sites operated by the Department of Ecology and data compiled by the Puget Sound Air Pollution Control Agency (PSAPCA). Non-attainment areas will be identified. Air pollution control strategies adopted by PSAPCA will be documented.

2.5.3 Impact Assessment and Mitigation

Construction Impacts

Implementing any of the alternatives would affect air quality both directly from construction equipment and related vehicles and indirectly through increased traffic congestion or traffic detours near construction zones. Direct impacts would not only

include exhaust emissions from construction equipment and vehicles, but also from dust blowing off uncovered trucks and from traffic related resuspended dust. Increased congestion near work zones could result in greater vehicle emission levels. The analysis will recommend mitigation measures depending on the type and scope of construction related impacts.

Mesoscale Analysis

A mesoscale air quality analysis will be conducted to document the change in regional emissions of air pollutants resulting from implementation of the RTP alternatives. The analysis will evaluate regional emissions of hydrocarbons, nitrogen oxides, and carbon monoxide. The analysis will be based on the changes in traffic operations forecast to occur as a result of the RTP system. Changes in vehicle miles of travel, operating mode, operating speed, and traffic flow conditions will be considered in the analysis. The analysis will also consider changes in emissions caused by any increase in electrical power generation required for the RTP. Motor vehicle emission rates will be estimated using the U.S. EPA's *MOBILE4.1* emissions model. The annual amount of regional air pollutant emissions associated with each of the RTP alternatives will be estimated and compared.

Microscale Analysis

The microscale air quality analysis will estimate future concentrations of carbon monoxide at specific locations in the vicinity of the RTP system. Critical locations will be selected for analysis based on the following criteria:

a. Traffic impact analysis will be used to identify those areas where the RTP system will have a significant impact on traffic flow. These areas will include proposed parking lots and facility expansions with significant trip generation potential.

b. Existing monitoring and air quality inventories will be used to identify existing CO hot spots potentially affected by the RTP.

c. The presence of sensitive land uses.

The microscale air quality analysis will generally follow procedures specified in the U.S. EPA manual, *Guidelines for Air Quality Maintenance Planning and Analysis Volume 9* (revised: Evaluating Indirect Sources.) Emission rates will be estimated using the *MOBILE4.1* mobile source emissions model. Intersection traffic flow characteristics will be analyzed using the ITE's *1985 Highway Capacity Manual*. Dispersion estimates will be made using the most recent EPA approved version of the *CALINE* model (3QHC). Background CO concentrations will be estimated based on existing monitoring data and in consultation with PSAPCA staff.

2.5.4 Conformity Evaluation

Air quality impacts will be evaluated by comparing predicted future CO concentrations to the state and federal air quality standards. The conformance of the project with the State Implementation Plan (SIP) and adopted air quality transportation control measures will be evaluated on consultation with PSAPCA staff pursuant to applicable conformity determination guidelines.

2.5.5 Documentation

Air quality monitoring sites and non-attainment areas will be mapped. Analysis methodologies and assumptions will be documented. Analysis results will be presented in tabular format and compared by alternative.

2.6 ENERGY

2.6.1 Introduction

An investigation will be conducted to determine energy requirements to construct and operate transit facilities. The task will identify regional energy supply and usage characteristics/trends and estimate energy requirements of transportation facilities relative to regional energy resources.

2.6.2 Baseline

The tasks needed to identify energy requirements and regional resources include:

a. Contact utility companies and local, state and federal agencies involved with energy production and distribution, including the Puget Power Company, Seattle City Light and the Washington State Energy Office.

b. Identify the sources of the regional energy supply and the existing and forecast consumption by the transportation sector under the No-Build Alternative.

c. Identify the forecast energy availability and documented costs/impacts of satisfying anticipated regional transportation needs.

2.6.3 Impact Assessment and Mitigation

a. Estimate for comparison the construction energy requirements of each RTP alternative.

b. Estimate and compare the operational energy requirements of each RTP alternative based on vehicle miles travelled, vehicle speed, operating mode, cold starts, and vehicle type.

c. Compare the energy requirements of each RTP alternative relative to available regional energy resources.

d. Identify the payback period of each RTP alternative in terms of the operational energy savings as compared to transit facility construction, and operational energy consumption compared to the no build alternative.

The impact analysis will identify energy costs and/or savings relative to the construction and operation of each RTP alternative. The relative energy costs and/or savings will be determined through a comparison of energy requirements for construction and operation of the alternatives compared to energy use under the no-build alternative. The analysis will consider if the energy requirements to build the alternatives can be offset by operational energy savings which would result from transportation system users changing to more energy efficient modes of transportation. Mitigation measures will include a discussion of alternative energy resources which may include conservation.

2.6.4 Documentation

Construction and operation energy requirements for each RTP alternative will be presented in text and in descriptive tables and figures. Impact assessment and mitigation measures will also be presented for each RTP alternative.

The operational energy needs associated with each alternative will be estimated based on vehicle technologies and operational characteristics, including changes in vehicle miles travelled, operating mode, operating speed and traffic flow conditions. The analysis will result in estimates of annual energy use by alternative and comparisons of the relative energy efficiency of the different modes.

Existing power generating characteristics of the region will be obtained from power company representatives to determine the ability of the utility to supply the RTP system.

<u>2.7 HAZARDOUS WASTE/MATERIALS</u>

2.7.1 Introduction

An investigation will be conducted to determine areas of historic or current manufacture, use or storage of hazardous materials. The task will identify known or suspected hazardous waste sites and evaluate their constraints on the RTP alternatives.

2.7.2 Baseline

The tasks required to identify potential hazardous waste sites include:

a. Review of Washington Department of Ecology (Ecology) and federal Environmental Protection Agency (EPA) dangerous waste site lists to ascertain if a site in question is on the list or if nearby properties that may potentially cause contamination of the corridor are on the list.

b. Contact local government agencies, such as the fire departments, health departments, planning agencies and private waste disposal companies to verify or identify suspected hazardous material users or handlers. Contact electric utility companies to obtain information on past uses of PCBs at power substations.

c. Review information from Ecology on the location and status of underground storage tanks located within the corridors.

d. Conduct field surveys of each corridor to identify potential unlisted hazardous material sites.

e. If necessary, conduct a Phase I site audit to further evaluate the likelihood of contamination at a site.

A Phase I site audit would be performed on sites in which contamination by hazardous materials is suspected, but not confirmed. This audit could include the following tasks:

a. Review of historical chain of title information, if available. Interview previous owners and discuss past site history and use. Review aerial photographs and telephone directories to document historical uses of property.

b. Interview present owners/tenants to discuss recent site history and use.

c. Visual inspection of the site to determine obvious signs of contamination or past practices that may have caused contamination. Current activities will also be reviewed to determine potential for future contamination of the site. The inspection will specifically include looking for signs of underground tanks (fill spouts, vents, etc.), electrical transformers that may contain PCBs, building materials that may contain asbestos, leachate, odors, industrial debris and discolored soils.

d. Research possible regulatory files from the Washington Department of Ecology, Environmental Protection Agency, Puget Sound Air Pollution Control Agency and local sewer and fire districts for information concerning permits and regulatory compliance.

e. Prepare a report documenting the findings of the audit. The findings of the audit will be incorporated into the DEIS.

2.7.3 Impact Assessment and Mitigation

The impact assessment will describe the constraints that the identified hazardous waste sites may have on the project. The analysis will evaluate and compare the constraints and costs of the site on each RTP alternative. The analysis will compare costs for each alternative for:

a. Cleanup and disposal of hazardous material on a worst-case basis;

b. Cleanup and disposal on a likely-case basis;

c. Avoidance of hazardous waste sites by modifying project alignments.

All work will be done in accordance with federal, state and local regulations including RHEA, Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), and Superfund Amendment and Reauthorization Act of 1986 (SARA).

2.7.4 Documentation

A map showing actual and potential hazardous waste sites and their relationship to the proposed corridors will be prepared. A technical report will describe the hazardous waste sites, their constraints on the alternatives under consideration, and the relative merits of cleanup of a site versus avoiding it by modifying the alignment.

TECHNICAL APPENDIX F

CAPACITY CALCULATIONS

The technical references and capacity calculations for the transportation facilities reflected in the DEIS Executive Summary are as follows:

Freeway General Purpose Lane (GPL)

Capacity, as defined by the 1985 Highway Capacity Manual (HCM), Special Report 209 prepared by the Transportation Research Board, is "the maximum (15-minute) rate of flow at which traffic can pass a point or uniform segment of freeway under prevailing roadway and traffic conditions." It is computed from the following:

$$SF_i = MSF_i \times N \times f_w \times f_{hv} \times f_p$$

where

SF_i = service flow rate for level of service (LOS) i under prevailing roadway and traffic conditions for N lanes in one direction, in vehicles per hour (vph);

MSF_i = maximum service flow rate per lane for LOS i under ideal conditions, in passenger cars per hour per lane (pcphpl);

N = number of lanes in one direction;

f_w = factor to adjust for the effects of restricted lane widths and lateral clearances;

f_{hv} = factor to adjust for the effect of heavy vehicles in the traffic stream; and

fp = factor to adjust for the effect of driver population.

In order to simplify the analysis the Freeway GPL was assumed to operate under the following ideal conditions:

1. twelve foot minimum lane widths,
2. six foot minimum lateral clearances,
3. all passenger cars and weekday commuters in the traffic stream, and
4. no interaction between adjacent freeway segments.

Under these conditions the adjustment factors, N, fw, fhv, and fp are equal to zero. the person capacity of each freeway GPL was then computed by multiplying the MSF (2,000 pcphpl at LOS E) by an average vehicle occupancy factor (AVO). These factors were obtained from the Washington State Department of Transportation Auto Occupancy Monitoring Program, Final Report prepared for the Puget Sound Council of Governments (PSCOG) by the Washington State Transportation Center (TRAC), 1990.

These calculations were performed at a number of screen line locations reflecting the highest regional use of I-90, I-405 and I-5. The averages resulting from these calculations are as follows:

2,000 pcphpl (LOS E) x 1.2(AVO) = 2,400 persons per hour

Calculation of the persons per hour capacity of a given freeway segment would follow the same process and N, in the equation above, would equal the number of freeway lanes in one direction.

During the peak hour at high demand locations, existing freeways are operating at level of Service (LOS) E or worse. The appropriate comparison is how many additional GPLs (or HOVs or Transitways or LRT lines) does it take to satisfy the existing and projected 2020 demand. This issue was analyzed in detail in the Screen line Capacity and Demand Study Technical Memorandum prepared by PB/KE dated August 1992.

Freeway HOV lane

The term capacity, as it is used to describe freeway general purpose lane operations, generally means maximum possible capacity. This condition is generally achieved only with the high-density traffic flow and speeds in the vicinity of 40 mph. Higher speeds can be sustained only when vehicular volumes are substantially below capacity. This condition is exacerbated when parallel GPL speeds are slowed during the peak period for non-barrier separated HOV lanes. Non-barrier separated HOV lanes operate safely with a differential speed no greater than 15 mph faster than parallel traffic. On a typical freeway, 55 mph speeds can be maintained only at volumes below 75 percent of capacity. Since HOV lanes must operate at or near the maximum legal speeds if they are to maintain their important travel time advantage, the above considerations limit the maximum volumes that can be carried without experiencing an unacceptable degradation of operational speed. The reference materials supporting these discussions are contained in the High Occupancy Vehicle Facilities Planning, Operating and Design Practices Manual, Parsons Brinckerhoff, October 1990.

Because HOV lanes have this unique combination of characteristics, there is no universally accepted procedure used to compute their capacity (or maximum service volume). In this study, HOV lane person-capacities at eight screen line locations were estimated using the transit procedures from Chapter 12 of the HCM as follows:

$$c_p = f'O_1 = [(MSFi - 2.5f')O_2]$$

where

c_p = total person capacity, in persons per hour,

f' = number of buses per hour,

O_1 = bus occupancy,

O_2 = car occupancy

MSF_i - maximum service flow rate for level of service i, in pcphpl.

In this equation the number of buses per hour is based on the number of routes scheduled past each screen line location during the peak hour for each alternative. The number of cars then reflects the auto capacity of the facility after subtracting the passenger car equivalents of the bases (assumed to be 2.5). The total person capacity then represents the number of people that can be carried by the specified number of buses and the remaining passenger car capacity.

In calculating the HOV lane capacities, the maximum service flow rate was limited to 2,400 vph in order to maintain operations at an approximate LOS C. Average bus and car occupancies were assumed to be 40 and, two to three respectively. The implications of these assumptions are addressed in the Washington State Freeway HOV System Policy Executive Summary, November, 1992. Using these assumptions resulted in the following capacity estimates:

(95 buses x 40 persons/bus) + (1,162 cars x 2 persons/car) = 6,124 persons/hour

(95 buses x 40 persons/bus) + (1,162 cars x 3 persons/car) = 7,286 persons/hour

These estimates were then modified to reflect the efficiency of the HOV in terms of the capital investments made in access and egress facilities resulting in a range of 4,800 to 5,700 persons per hour; approximately 80 percent of the calculated capacity.

Transitway Lane

High person capacities can be achieved by assuming that an exclusive bus operation would occur on the Transitway facility. With a maximum flow rate of 1,400 vph, a passenger car equivalency factor of 2.5, and an average bus occupancy of 40, a theoretical way capacity of 560 buses per lane per hour or 22,400 persons per lane per hour could be achieved under this scenario. However, use of this theoretical capacity would not accurately reflect the transit service or capital elements planned for each alternative. Accommodating this type of bus flow would require a much larger capital investment in entrance ramps, exit ramps, priority treatments, terminal facilities, and vehicles than is currently planned. For these reasons Transitway capacity was estimated as follows:

235 buses/hour x 40 persons/bus = 9,400 persons/hour

In this estimate the 235 buses per hour represents the maximum number of buses that could be accommodated given projected demand and the programmed capital investment.

Light Rail Line

The capacity of a rail transit line is determined by the lesser of the computed way capacity or station capacity. Typically, station capacity governs since the minimum achievable headway between successive trains is much longer at stations than between moving trains along line sections between stations. It is a function of train-station platform length, vehicle size, allowable passenger loading densities, and the minimum headway between trains.

Rail line passenger capacities in the peak direction during the peak hour were estimated from the following:

$$\text{Passengers/hour} = \frac{\text{Trains}}{\text{Hour}} \times \frac{\text{Cars}}{\text{Train}} \times \frac{\text{Ft}_2}{\text{Car}} : \frac{\text{Ft}_1}{\text{Passenger}}$$

The number of trains per hour or minimum headway that can be accommodated is dependent on several factors. These include train length, type of train control system (manual versus block signals), and station dwell time which is dependent on platform design (low versus high), method of fare collection (Prepayment versus pay on train), and number of doors per train. Previous studies, which assumed block signaling systems, high platform stations, prepaid fare collection, four doors per side of vehicle, and station dwell times less than 40 seconds, concluded that the practical minimum headway for the RTP Rail Alternative is about 90 seconds.

To compute the rail line capacities, a 90 second minimum headway was used as a combined headway for the rail routes that merge in the Downtown Seattle Transit Tunnel (DSTT). Using this 90 second headway and assuming four cars trains carrying 140 passengers per car, the maximum rail line capacity in excess of 22,000 passengers per hour in each direction (40 trains per hour per direction x 4 cars per train x 140 passengers per car = 22,400 passengers). The Federal Transit Administration (formerly UMTA) has issued a Procedures and Technical Methods Manual for Transit Project Planning, September 19186, which served as a reference to support this analysis.

The rail capacity number (22,000 passengers per hour in each direction) is higher than is expected to be achieved by the year 2020. It reflects a potential capacity which can be achieved in the future.

GLOSSARY

Accessible Transportation Facilities. Transportation facilities that are barrier-free, allowing use by all travelers, including the physically handicapped, elderly, and transportation disadvantaged.

Active Coaches. The total bus fleet necessary to meet peak or rush-hour demand; includes spare buses.

Activity Center. An area of centralized land use activity, such as a shopping center, industrial park, business district, etc.

ADT (average daily traffic). The average number of vehicles passing a point during a 24-hour period.

Aerial Structure. A rail or bus structure elevated above the adjacent natural surface, usually on columns.

Alignment. The horizontal and vertical path followed by a rail line, busway, transitway, or other public work.

Alternative. A reasonable option for addressing corridor transportation problems.

Alternatives Analysis. The Federal planning procedure undertaken to determine whether a fixed rail, busway, or transitway alternative is cost-effective.

Arterial. A major thoroughfare, used mainly for through traffic rather than access to nearby property. Arterials usually have large traffic capacity and are designed for continuously moving traffic.

Articulated Coaches. An extra-long, high capacity bus or trolley bus that has the rear body section or sections flexibly but permanently connected to the front section. The arrangement allows the vehicle to bend in curves without interior barriers to prevent movement between the two parts. Typically, an articulated bus is 54 to 60 feet long and has a passenger seating capacity of 60 to 80.

At-Grade. Following the existing surface.

Bicycle Amenities. Facilities designed and built specifically for bicycles and bicyclists using public transportation.

Bus Bulb. A branch of or widened area of a road that lets buses stop while loading or unloading passengers without blocking traffic. A bus bulb is designed to allow the bus to reenter traffic easily.

Busway. A section of roadway generally separated from other road facilities and built and operated exclusively for buses.

Capital Cost. The expense of putting an alternative into operation, including construction costs, materials, installation of equipment, and purchase of vehicles.

Carpool. Two or more people sharing the use, cost, or both or traveling in privately owned automobiles between fixed points on a regular basis.

Central Business District (CBD). The downtown area of a city.

Circulator Service. Bus service confined to a specific area, such as a downtown or suburban neighborhood, with connections to major travel corridors.

Committed Improvement. An improvement which has been funded or has funds committed to it.

Commuter Rail. A passenger railroad service that runs within metropolitan areas on tracks that are usually part of the general railroad system. The operations, mainly for commuters, are usually during rush hours.

Corridor. A long, relatively narrow area within a region that includes a major direction of traffic flow or connects major sources of trips.

Cost-Effectiveness. Ability to attract a large proportion of new riders and improve travel times for existing riders in proportion to capital and operating costs.

Custom Bus. A subscription bus service serving a group of riders with the same work or school destination.

Deadhead. The time a transit vehicle is operating but is not in revenue service.

Demand. The amount of transportation desired by the public.

Demand Responsive Transit. Transit service using small vehicles with flexible routes and schedules, providing door-to-door or point-to-point transportation, often at the customer's request.

Dial-a-Ride. A demand-responsive system in which curb-to-curb transportation is provided to people requesting the service by telephone, either on an as needed or subscription basis.

Draft Environmental Impact Statement (DEIS). A comprehensive study of likely environmental impacts that will result from a project.

Dual Powered Bus. An articulated bus equipped with a diesel engine and an electric motor. dual-power buses can operate in either mode (assuming overhead trolley wire is available) but not both modes at the same time.

E-3 Busway. A new busway between 4th and 6th Avenues S, extending from the International District Station to S Spokane Street.

Efficiency. Leading to optimum public transportation use of existing facilities.

EIS. Environmental Impact Statement.

Elevated Profile. An alignment that runs above the natural ground surface, either on an aerial structure or on fill.

Endangered Species. A species in danger of extinction throughout all or a significant portion of its range.

Express Bus Service. Bus service with limited stops, whether from a collector area directly to a specific destination or in a particular corridor with stops on route at major transfer points or activity centers. Express bus service usually uses freeways, busways, or transitways when available.

Fatal Flaw. An engineering or environmental problem with an alignment that makes that alignment impractical or infeasible.

Federal Corridor. The one corridor of the three under study for which Metro will seek federal funding.

Feeder System. Local transportation service that connects to main-line regional service.

Final Environmental Impact Statement (FEIS). An update to or revision of a Draft EIS which incorporates responses to comments on the DEIS, as well as any new information on the project and its environmental effects.

Finance Advantage. Ability to attract financial or other contributions from the private sector and from federal, state, and local public agencies.

Fixed Route/Fixed Schedule Transit Service. Conventional transit service that follows regular, unchanging routes and schedules.

FTA. Federal Transit Administration (formerly Urban Mass Transit Administration (UMTA)). A component of the U.S. Department of Transportation which administers the federal transit program.

Grade Separation. Separating intersecting facilities vertically (roads, rail, transitways, etc.) by providing crossing structures.

Headway. The time between transit vehicles on the same route.

Heavy Rail. A train system, usually powered by electricity, that runs on tracks or roadways built exclusively for rapid transit and separated physically from all other traffic.

High Occupancy Vehicle (HOV). A bus, carpool, or vanpool.

Home-Based Trip. A trip that has either its origin or destination at the traveler's residence.

HOV Improvement. Facilities or priority treatments, such as preferential signalization or queue bypasses, designed to improve HOV roadways.

HOV Lane. A highway or street lane reserved for use of HOVs.

HOV Priority Treatment. A facility which gives HOVs priority at intersections, entrances, exits, or traffic signals.

Hundred Year Flood. The highest flood that has a one percent chance of occurring in any particular year.

Hydrology. The paths by which ground and surface water can be expected to flow.

Interim Terminal. The temporary end point of a rapid transit line after a construction phase.

Joint Development. Coordinated ventures between public and private sectors for developing land above, below, or next to transportation facilities.

Land-Use Density. The level of compactness of urban development, usually described as population or dwelling units per acre.

Level of Service (LOS). A qualitative rating of how effectively a roadway serves traffic.

Light-Rail Transit. A transit system that uses electric rail cars similar to a streetca4r running alone or in short trains on fixed, two-rail guideways (tracks).

Linked Trip. A trip from the point of origin to the final destination, regardless of the number of modes or vehicles used.

Local Bus Service. Bus service that picks up and drops off passengers at frequent, designated stops on city streets.

Maglev (Magnetic Levitation). Support technology that keeps a vehicle vertically separated from its track and riding surface by magnetic force.

Maintenance Base. A transit vehicle base with facilities for maintaining the vehicles.

Maintenance Cost. The cost of upkeep of vehicles, alignments, structures, machinery, and equipment.

Methodology. The methods used to estimate the social impacts, economic impacts, environmental impacts, capital costs, operating and maintenance costs, service and patronage impacts, and financial impacts of the alternatives and to compare them with each other.

Mitigation. Steps taken to moderate the impact of construction or operation of a project.

Mobility. Degree to which the transportation system's capacity is increased and to which the proportion of transit users increases.

Mode. Means of transportation.

Mode Split. The statistical breakdown of travel by alternate modes, usually expressed as a percentage of travel by auto, transit, etc. Mode split is frequently used to describe the percentage of people using public transportation, as opposed to the percentage using private automobiles.

Model. A mathematical or conceptual description of a real life situation that uses data on past and present conditions to make a projection about the future.

Monitor Species. A species of special interest because it: (1) has significant popular appeal; (2) requires limited habitat during some portion of its life cycle; (3) is an indicator of environmental quality; (4) requires further field investigation to determine population status classification; or (5) was justifiably removed from endangered, threatened, or sensitive classification.

Monorail. A transit system (usually elevated) made up of electric-powered vehicles guided by a single rail or beam.

Mutagenicity. The ability to cause genetic mutation in a cell or organism.

Network. A system of links and nodes of transit routes that describes a transportation system.

National Environmental Policy Act (NEPA). A comprehensive federal law requiring an analysis of the environmental impacts of federal actions.

No-Build Alternative. The alternative which leaves the situation as it already exists.

Non-Home-Based Trip. A trip that has neither its origin or destination at the traveler's residence.

Off-Peak Direction. Traffic flow going opposite to the majority of traffic during the rush hour, usually away from downtown or an activity center in the morning and toward downtown or an activity center in the evening.

Off-Peak Service. Service that takes place outside of rush hours.

Operating Cost. All recurring costs that can be associated with the operation of the system during the period under consideration.

Operations and Maintenance. Activities necessary to run and maintain a system.

Paratransit. Forms of transportation services that are more flexible and personalized than conventional fixed route, fixed schedule service, but not including services such as charter bus trips. The vehicles are usually low- or medium-capacity highway vehicles, and the service offered is adjustable in various degrees to individual users' needs.

Park-and-Pool. A carpool method where individuals drive alone to a prearranged point to meet with others to travel together to their destinations.

Park-and-Ride Lot. A parking lot where transit riders can leave their cars and ride a bus or other transit mode to another location.

Peak Direction. The direction of major traffic flow on a highway or transit facility during rush hours.

Peak Hour. The hour during which the maximum amount of travel takes place.

Peak Period. The period during which the maximum amount of travel occurs. Usually about 7 to 9 a.m. in the morning and 4 to 6 p.m. in the evening.

People-Mover. An automated transportation system that provides short trips to or through an activity center.

Person Trip. A trip made by a person by any mode or combination of modes for any purpose.

Personalized Rapid Transit (PRT). A small, low-speed guideway transit system using small vehicles designed to provide personalized service by traveling to a desired stop without intermediate stops.

Platform Hours. The number of hours that all or some of the coaches in the active fleet are in service. Includes deadheading and layover.

Platform Miles. The number of miles traveled by all or some of the coaches in the active fleet within a given period of time.

Practicality. Ease of implementing the alternative by the year 2000.

Queue Jump. A short section of exclusive or preferential lane that allows specified vehicles to pass a line of automobiles or a congested traffic section.

Rapid Transit. A transit system serving an urban area using relatively high-speed rail cars or buses in exclusive rights-of-way, without grade crossings.

Relocation Compensation. Money given to businesses or residents displaced by a project, in addition to that needed to acquire properties, to partially or fully pay the costs of moving to a new location.

Respirable. Capable of being inhaled into the lungs.

Retained Cut. An alignment in a passageway below the normal ground surface, open to the sky and with retaining walls on the sides.

Ridership. The number of people making one-way trips on a public transportation system in a given time period.

Ridesharing. Vanpooling and carpooling.

Right-of-Way. Land acquired for or occupied by a transportation alignment, including unused space along the edges or median of the alignment.

Scoping. A process occurring near the beginning of an Alternatives Analysis/Draft Environmental Impact Statement study that involves the public interest groups, and government agencies in defining alternatives to be evaluated, identifying impact issues to be addressed, and defining a public involvement program.

Scoping Meeting. A formal opportunity for the public, interest groups, and government agencies to provide input on the alternatives to be evaluated and issues to be addressed in an Alternatives Analysis/Draft Environmental Impact Statement.

Screening. Identification of the most reasonable alternatives and elimination of unreasonable alternatives from further consideration.

Single-Occupant Vehicle (SOV). A motor vehicle carrying only one person.

Sensitive Species. A species that could become threatened if current water, land, and environmental practices continue.

Threatened Species. A species that could become endangered in the foreseeable future without active management or removal of threats.

Transit Center. A transit stop or station at the meeting point of several routes or lines which is designed to facilitate passenger transfers.

Transit Dependent. Relying on transit services instead of the private automobile as the main means of travel.

Transit Incentives. Actions encouraging the use of public transit, including increased service and reduced fares.

Transitway. An exclusive right-of-way that is used both by transit and high occupancy vehicles.

Transportation Demand Management. Managing the amount of transportation wanted. Development of policies and programs to motivate people to use public transportation, such as bus pass subsidies, flex-time programs, and limiting free parking.

Transportation Systems Management. Making better use of the existing transportation system by using short-term, low-capital transportation improvements that cost less and can be implemented more quickly than a rapid transit system.

Trip. A one-way movement of a person or vehicle between two points for a specific purpose; sometimes called a one-way trip to distinguish it from a round trip.

Trolley Bypass. Overhead electric trolley wire that allows express trolleys to pass other trolleys making local stops.

Trolley Overhead. The existing or proposed trolley network with overhead wire for electric power.

Unlinked Trip. Any segment of a linked trip.

Vanpool. An organized ridesharing arrangement in which a number of people travel together on a regular basis in a van. Expenses are shared, and there is usually a regular volunteer driver.

Wetland. An area that is periodically saturated with water, has soils that have developed under saturated conditions, and contains plant life characteristic of such areas.

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DISTRIBUTION LIST

GOVERNMENT AGENCIES & JURISDICTIONS

Federal

- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Interior, National Park Service, NW Div.
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- Federal Transportation Administration
- Federal Highway Administration, Division Administrator
- Federal Emergency Management Agency
- U.S. EPA Region 10
- U.S. EPA Wash. OPS Office
- U.S. Fish & Wildlife Service
- Advisory Council on Historic Preservation, Western Office of Project Review

Tribes

- Muckleshoot Tribe of Indians
- Puyallup Tribe of Indians
- Tulalip Tribe of Indians

State

- Office of the Governor
- Department of Community Development
- Department of Ecology
- Department of Fisheries
- Department of Wildlife
- Department of Transportation
  - HCT Expert Review Panel
- Office of Archaeology and Historic Preservation
- University of Washington
- Washington Parks & Recreation Commission

Regional

- Puget Sound Air Pollution Control Authority
- Puget Sound Regional Council

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- City of Dupont
- City of Duvall
- City of Edmonds
- City of Enumclaw
- City of Everett
- Everett School District No. 2
- City of Federal Way
- City of Fife
- City of Granite Falls
- City of Issaquah
- City of Kent
- City of Kirkland
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- City of Stanwood
- City of Lake Stevens
- City of Lynnwood
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- City of Monroe
- City of Mountlake Terrace
- City of Mukilteo
- City of Normandy Park
- City of North Bend
- City of Pacific
- City of Puyallup
- City of Redmond
- City of Renton
- City of Roy
- City of Sea Tac
- City of Seattle
    - Seattle City Light
    - Seattle Planning Commission
- City of Snohomish
- City of Snoqualmie

DISTRIBUTION LIST

City of Sumner
City of Tacoma
    Tacoma Environmental Commission
City of Tukwila
City of Wilkeson
Town of Beaux Arts
Town of Clyde Hill
Town of Eatonville
Town of Fircrest
Town of Hunts Point
Town of Milton
Town of Orting
Town of South Prairie
Town of Sultan
Town of Woodway
Town of Yarrow Point

COMMUNITY, BUSINESS, ENVIRONMENTAL & OTHER INTEREST GROUPS

Bellevue Downtown Association
Citizen's Transit Advisory Committee
Eastside Transportation Committee
Eastside Transportation Program
EDC of Seattle and King County
EDC of Snohomish County
Everett Area Chamber of Commerce
For Everett
Greater Renton Chamber of Commerce
Greater Seattle Chamber of Commerce
Intercity Transit
Leagues of Women Voters of King Co.
Municipal League
North Renton/Kennydale Neighbohood
Puget Power
Puget Sound Light Rail Transit Society
Queen Anne/Magnolia Noise Abatement Group
Rainier Beach Commuity Club
Seattle Community Council Federation
Seattle Economic Development Council
Seattle/King Asssociation of Realtors
Sierra Club
Sounding Board
Southeast Effective Development, Inc.(SEED)
Snohomish County Committee for Improved Transportation
Southwest King County Chamber of Commerce
Washington Environmental Council
Washington Natural Gas
Washington Society.of Professional Engineers
Washington Transportation Policy Institute
Bernard Development Company
The Burke Associates
Pathfinder Systems, Inc.
Soft Pages, Reed
TDA, Eager

DISTRIBUTION LIST

M2, Wieckowicz

INDIVIDUALS

All individuals commenting by letter, comment sheet or testimony at the public hearings on the draft EIS were sent a copy of the final Environmental Impact Statement. See Chapter 5 for a list of names.

LIBRARIES

Auburn Public Library
Bothell Library
Bellevue Public Library
Brier Library
Edmonds Public Library
Everett Community College Library
Everett Public Library
Granite Falls Library
King County Library
Lake Stevens Library
Lighthouse for the Blind
Lynnwood Public Library
Marysville Library
Metro Library
Mill Creek Library
Monroe Library
Mountlake Terrace Library
Mukilteo Library
Municipal Reference Library
Renton Public Library
Seattle Public Library
University of Washington, Suzzallo Library

NOTICE OF ISSUANCE

The following groups were sent a notice of issuance for the final Environmental Impact Statement.

A Thousand Friends of Washington
Action Council for Esperance
Admiral Community Council
Alderwood Community Council
Alderwood Water & Sewer District
Alki Community Club
Alki Community Council
Allied Arts of Seattle
American Association of University Women
American Association of Retired Persons
American Insitute of Architects, Seattle Chapter
American Lung Association of Washington
American Planning Association - Washington Chapter
Asian Counseling and Referral Service, Inc.
Association of Washington Cities
ATU Local 587, Dan Linville
Auburn Rotary Club
Ballard District Council

DISTRIBUTION LIST

Bellevue Downtown Association
Brentwood Neighborhood Assoc.
Brier Citizens Committee
Brighton Community Council
Burlington Northern Railroad
Canyon Firs Homeowners Committee
Capitol Hill Community Council
Capitol Hill District Council
Cascade Area Business Neighbors (CABN)
Cascade Bicycle Club
Cascade Community Council
Cascade Natural Gas
Center Park Resident's Council
Central Area District Council
Central Seattle Community Council Federation
Chehalis Western Railroad
Church Council of Greater Seattle
Citizens to Save Puget Sound
Civic Club of Lk Forest Pk
Coalition of Labor & Business
Columbia City Neighborhood Association
Concerned Citizens of Georgetown
Concerned Citizens of Snohomish County
Delridge District Council
Downtown District Council
Downtown Seattle Association
Duwamish View Improvement Club
East Bellevue Community Council
Eastgate Sewer District
Edmonds Council of Concerned Citizens
Edmonds Water & Sewer Dept.
El Centro de la Raza
Fauntleroy Community Assoc.
Federal Way Community Council
First Hill Improvement Association
Floating Homes Association
Forbes Water District
Frederick-Clover Creek Community Council
Fremond Neighborhood Council
Friends of Westcrest Park
Greater Burien Community Council
Greater South Park Association
Greenlake Community Council
Greenpeace NW
Greenwood Community Council
GTE
Haller Lake Improvement Club
Highland park Action Committee
Hillman City Neighborhood Association
Hilltop Concerned Citizens
Holly Park Community Council
Human Services Roundtable
Inglewood Shores Homeowners Association
Institute for Transportation and the Environment
Judkins Rejected Community Council

DISTRIBUTION LIST

Kennard Corner Homeowners
Kirkland Alliance of Neighborhoods
Lake Ballinger Comm Club
Lake TV Cable
Larch Way Neighborhood Preservation Assoc.
League of Women Voters of Tacoma - Pierce County
Licton Springs Community Council
Lynnwood Water & Sewer Dept.
Magnolia Community Club
Martha Lake Community Club
Martha Lake Homeowners
Marysville Chamber of Commerce
Marysville School District #25
Minority Exec. Directors Coalition
Mount Baker Community Club
Mount Baker Housing Association
The Mountaineers
Mountlake Terrace Water & Sewer Dept.
Mt. Rainier Nat'l Park Assoc.
Mukilteo School District #6
Mukilteo Water Department
Municipal League of Tacoma/Pierce Co.
National Council of Senior Citizens, Puget Sound Council
Neighborhood Business Council
North Beacon Hill Coalition
North City Community Council
North Lake Wash Comm. Coalition
North Lynnwood Community Council
Northeast District Council
Northshore School District #417
NW Bicycle Foundation
NW Steelhead & Salmon Council - Elliott Bay Chapter
Olympic View Water District
Olympus I Homeowners Assoc
Oso Water Company/Doemus
Pacific Northwest Bell
People for Downtown Housing
Phinney Ridge Community Council
Pierce Co. Citizens for Improved Transportation
Pilchuck Audubon Society
Puget Sound Alliance
Puget Sound Council of Sr. Citizens
Puget Sound Power & Light
Puget Sound Water Quality Authority
Queen Anne Community council
Rainier Beach Community Club
Rainier Vista Community Council
Ravenna/Bryant Community Association
Renton Rotary
Richmond Beach Community Club
Richmond Beach Community Council
Roosevelt Neighborhood Association
Rotary Club of Seattle
Rubatino Refuse Company
Seattle Bicycle Advisory Group

DISTRIBUTION LIST

Seattle Housing Authority
Seattle Neighborhood Coalition
Seattle Urban League
Save Our University Place
Sheridan Beach Community Club
Shoreline Community Council
The Sierra Club, Komo Kulshan Group
Silver Lake Sewer & Water District
Smokey Point Area Chamber of Commerce
Snohomish County League of Women Voters
Snohomish Wetlands Alliance
South Snohomish County Preservation Assoc.
Soos Creek Water and Sewer District
Sounding Board
South Atlantic Community Council
South Beacon Steering Committee
South County Homeowners Assoc.
South Hill Comm. Council
South Park Community Club
South Snohomish County Chamber of Commerce
Sunset Hill Community Club
Tacoma Area Chamber of Commerce
Tacoma-Pierce Co. Economic Development Board
Tacoma League of Women Voters
Tacoma/Pierce County Chamber of Commerce
The Breakfast Group
Transportation Discussion Group
Union Pacific Corp.
United Neighborhoods of Tacoma
University Community Council
University District Community Council
UW Inst. for Public Policy & Management
Valley Area Transportation Alliance
Vision Seattle
Wallingford Community Council
White Center Chamber of Commerce
Willowcrest
Wingate Homeowners Assoc
Women's Transportation Seminar
Woods Trails Homeowners

Media

Bellevue Journal-American
Daily Journal of Commerce
Edmonds Tribune Review
Everett News Tribune
KCPQ TV
KCTS TV
KING TV
KING 1090
KIRO Radio
KIRO TV
KOMO TV

DISTRIBUTION LIST

KRKO 1380 AM
KUOW
Mill Creek Enterprise
Mill Creek Tribune
News Tribune
Pierce County Herald
Queen Anne/Magnolia News
Robinson Newspapers
Seattle Post-Intelligencer
Seattle Times
The Enterprise
The Herald
The Weekly
Valley Daily News
Valley Newspapers